THE IRANIAN SPACE ENDEAVOR

Ambitions and Reality

Parviz Tarikhi

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To my wife Zohreh, my sons Shahryar
and Kamyar, and my parents Ahmad Tarikhi
and Marzieh Ravandi, for kindly and sincerely
supporting me all the time and encouraging
me to realize the great wishes in my life,
be strong, overcome the difficulties and stand up!

Prologue

It was the morning of a hot sunny summer's day in late August in 2007. I was driving to my new work place at the remote ground receiving station for the first time. It was situated near a small state airport, and the route was rocky and rough, full of cavities and holes. Driving the car was difficult and it was raising pillars of dust behind. After 15 years of working in the capital, I was transferred to this remote station. My mind was reviewing all the events that I had witnessed during those years. Like the time I was employed by the remote sensing center. My perseverance and knowledge drew the attention of the authorities, whilst also raising the envy of some colleagues. However, I was always advancing rapidly and promisingly. In 2000, I was sent to participate in the meetings of the *United Nations Committee on the Peaceful Uses of Outer Space* as the scientific and technical delegation member. Soon thereafter, I chaired an action team focusing on the global strategy for environmental monitoring established by the committee. Several years later, I was selected as the bureau member of the committee. At that time I was the youngest member of the bureau in the half-century since the committee was established, and the first Iranian member. With the official establishment of the national space agency in Iran in 2004, my responsibility increased, and by late 2005 I had gained a lot of respect and reputation by working alongside the first president of the agency.

Driving to the receiving station, I recalled the meeting held a couple of days earlier, at 11:30 am on Wednesday, August 21, 2007, at the office of the president of the space agency. He was present along with myself and three of his most devoted assistants and trustees. At the end of the session, which very much resembled a field military trial because only the president spoke, I received an oral instruction to leave the headquarters and start working at the remote site of the Mahdasht Satellite Receiving Station that was affiliated to the agency and on a sprawling tract at the foot of some hills in a suburb of Karaj, 65km west of Tehran. I was still the head of the office for specialized international cooperation of the agency, and sending me to Mahdasht without dismissing me served only to banish me from my specialized function. I was disappointed and felt the situation unjust. I was so frustrated that I thought perhaps I should write about my experiences. But I realized that I must think the matter over carefully before taking to my pen.

Mahdasht Satellite Receiving Station was well-known for satellite data acquisition all around the globe in the 1970s and the beginning of the commercialization of remote sensing technology, but was abandoned for years after the revolution of 1979 in Iran. From the viewpoint of the staff and personnel of the Iranian Remote Sensing Center, and later the Iranian Space Agency, it was used mainly to exile those staff members whom the executives of the agency were disappointed with and wished no longer to have in their presence. The abandoned station was similar to a remote island. Everyone whom the authorities disliked was easily banished there. Prior to the official establishment of the space agency, the Iranian Remote Sensing Center was the national body for space-related issues. The Iranian Space Agency was formed in 2004 by combining the center with some other institutions. As a space science and technology expert at the remote sensing center in Tehran, my employment extended to the Iranian Space Agency upon its establishment. I emerged in the era of reform-mindedness and high intention towards democratic changes in Iranian society during the course of the 1990s and the early years of the third millennium. In the wake of the presidential elections of 1997 in Iran that led to a reformist state, the political and social status of the country altered considerably. There was an attempt to disrupt the tight circles of exclusivity in different aspects of society and extend an atmosphere of democracy and open-mindedness to accommodate dissidents. The results were very effective at both the domestic and international levels. Unfortunately, the presidential elections of 2005 changed all this. From 2000 to 2006, I was in charge of coordinating and conducting specialized international cooperation issues. That period is widely acknowledged to be the most successful for the space agency in the field of international cooperation. Keeping me away from the official activities of international cooperation followed the appointment of the second president of the agency in October 2005. Although I was still advancing my grades within the agency, it mendaciously explained away my enigmatic absence from the international arena with childish and irrational justifications.

Upon being banished to Mahdasht, I began a new and very different phase of my life. Although Mahdasht was a remote and outlying site, and I necessarily missed of the privileges and opportunities that I had enjoyed, it was a calm place that was free of the ever-increasing bigotry and imprudence at the agency. Besides my routine official functions, I pursued my international relations and cooperation with the world community in a friendly fashion, but only unofficially. There I continued my research in microwave remote sensing, and in particular synthetic aperture radar interferometry. I continued working for the PhD in physics which I had started several years earlier, and was able to submit my dissertation at the end of 2008. I became a doctor of philosophy in physics the following year. As a result of the ethical crisis in Iran, those years were conflicted and disputed times in the political arena and also subsequently in top-level management. This affected the society, economy and the strategies driving the nation. In the shadow of its insalubrious status, the top authorities of the agency took full advantage of opportunities to libel and accuse personnel, including myself. Such deeds were hidden, but there was one main operator whom almost everyone knew. But he was only one piece of a much greater jigsaw of corruption that developed in those times of profiteering and political tension in the country. The appointment of the third president of the space agency ended those games temporarily, although they soon resumed and became the new order at the agency. The dismissed president was rewarded by the new authorities with a top space-related

appointment in the regional organization in the Asia-Pacific. Stories in the media and in publications of his incompetence, dishonesty and misuse of his position and authority provoked me to observe the ongoing status with more care and attention and also to extend the domain of my view and observation wider to cover almost the whole of Iranian space activities. This convincing me that corruption in the system was more deeply rooted than I had imagined, and was hamstringing Iran's space endeavor. The years spent at Mahdasht provided me a unique opportunity to observe the issues, behavior and ongoing activities related to the Iranian space endeavor, and my long personal involvement in this endeavor and knowledge of it provided a solid basis to study and analyze the situation. This reaffirmed my desire to publish my observations and experiences. This book is the result. Although writing about Iran's space endeavor in recent decades from the diagnostic point of view may not seem as easy as writing on technical and scientific matters, and could at the same time be perilous, as a technocrat who has worked internationally for years and has carefully observed the trend of the changes at the Iranian Space Agency, I feel obligated to write about the things I have witnessed in the course of many years of working in this field.

Perhaps it is difficult for those who look at the trend of the progress and movement of the Iranian space endeavor from outside to accept what goes on behind the scenes, but these influences are very real for those on the inside. In this book, I try to shed light on aspects of the Iranian space endeavor that are difficult for the outside observer to recognize. In addition to technical factors, I will explain historical, legal, social, and cultural profiles. By providing insight into the Iranian space endeavor, I hope that the book will be of interest to readers around the world. Iran claims to be the ninth leading country in the world with the capability to manufacture and launch its own satellites, and it plans to launch an astronaut to the Moon by 2025. The chancellor of one of Iran's top universities has stated his wish to hold a collective prayer ceremony on one of the planets. The president of state would like to be the first Iranian astronaut to travel into space. He is even ready to auction himself to assist the progress of Iran's space plan. However, as this book shows, there is much more to the Iranian space endeavor. Its realm is considerably farther-reaching than the propaganda would suggest, and I shall explore this in detail.

By writing this book in English, I am addressing the international space community, although it will hopefully also awaken Iranian citizens to the nature of their space endeavor. I believe the world community should have a real and clear vision about this endeavor and be aware of both its positive and its negative aspects. Iran needs international cooperation. It is hard for others to cooperate with Iran without the benefit of an informed viewpoint. Hopefully after reading this book the reader will understand the reasons for a lot of discrepancies. I have tried to explain which parts of Iran's space endeavor are reliable and a valid basis for cooperation, and those about which the world ought to be more skeptical. However, the final judgment is left to the reader.

The book has 11 chapters. Chapter 1 is a brief introduction to the topic. Chapter 2 explains how the infrastructures for aeronautics that were developed earlier in Iran served and assisted the development and growth of indigenous space industries. Chapter 3 focuses the development of education, research and public awareness, and reveals how education at the academic level has played a key role in Iran's space endeavor by providing the specialized human resources and early research on the subject. Then Chapter 4 explains the

outreach efforts of the Iranian space endeavor and its international cooperation, and how this has been retarded by the authorities in recent years. Chapter 5 focuses on the legislation and management of the endeavor, and how it has since been hamstrung by legislative, managerial and administrative turmoil. The attitudes and visions, as well as the character of the leaders of the space administration are examined in detail, since these influence the pace, progress and development of the space endeavor. Administrational space research activity is dealt with in Chapter 6, which shows how the research is trapped in an official bureaucracy that reduces its efficiency. Chapter 7 deals with the space applications and services that are treated with disfavor. Chapter 8 discusses the development of domestic satellites, launchers and ground facilities. It explains that the nature and aim of developing Iranian satellites before Omid was quite different from Omid and all subsequent satellites. Chapter 9 discusses ambitions, shortsightedness and paranoia in the Iranian space endeavor. From a managerial point of view there is practically no discernible distinction in the recent septennial between ambitions and delirium, which are emerging in a mixed fashion. This substantially reflects efforts for hegemony and control. Although the genuine ambitions provoke a sense of pride and respect that Iranian society has long yearned to retrieve, the shortsightedness and paranoia are annoying and disappointing to the technocracy that continues to smolder like the fire under the ashes. Chapter 10 is a discussion of how the pace of the Iranian space endeavor is threatened by the ethical crisis, imposture and abandonment of principles. Chapter 11 discusses, argues, analyzes, concludes, and portrays an outline of the future and its requirements. The book concludes with a list of abbreviations, the statutes of the Iranian Space Agency, and an autobiography of the author, whose background is intimately linked with the Iranian space endeavor.

My special gratitude goes to Henk H. F. Smid, for his invaluable advice and assistance, and for kindly and carefully proofreading the manuscript.

Karaj, Iran
May 2013

Parviz Tarikhi

1

Introduction

Space, unlike the realms of land, sea and air, belongs to all humankind, and every human being has an equal right to benefit from it. A country or a nation can recognize, identify, and even develop a land or part of a sea as its property, or claim the skies overhead as its sovereign territory. Throughout history, nations and countries in all parts of the world have attempted to add to their realms the lands and seas in their vicinity in different ways, often fighting wars in the process. Some have even claimed remote lands and entire continents. But this is not the case for space. No nation or country can claim a part of space, a region of a celestial body, or an entire body to be its property. Instead, humankind as a whole, irrespective of nationality, race, color, or position on the globe, can use space for the benefit of all and try to develop, explore, and discover it for the benefit of the Earth and its inhabitants. In space, the rule of *res communis omnium* applies, and this multinational and international identity distinguishes it from other realms.

Although there is no firm boundary for where outer space begins, the altitude of 100km above sea level is conventionally accepted for the purpose of space treaties and aerospace records. According to the Outer Space Treaty that was passed by the United Nations in 1967 and serves as a framework for international space law, all claims of national sovereignty are precluded and all states are permitted to explore outer space freely. Moreover, the Moon Treaty passed in 1979 made the surfaces of celestial bodies of all sizes up to and including planets, as well as the orbital space around them, the realm of the international community. As Figure 1-1 shows, the domains of the space endeavors by nations and international organizations – namely life in space, space exploration, improving daily life, protecting the environment, and national security – can benefit from communications as the main infrastructure, and from space remote sensing, GPS and GIS applications as the tools for management, control, and planning. In all domains, even national security, individual nations rely upon bilateral, regional, and international cooperation and interaction. The important point is to conduct this interaction such that each nation respects the humanitarian rights of other nations and without seeking supremacy.

That is why, right from the start of the Space Age, all spacefaring and other nations attempted to develop concepts for international cooperation in space and to consider space as serving the interests of all humanity; not those alive at that time but also future generations. As in the case of many other humanitarian issues, the United Nations took the lead

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1.1 The main domains of the space endeavor of nations and international organizations, and the interrelating technologies of communications, space remote sensing, GPS and GIS applications as tools for management, control and planning.

by drawing up national and global agreements. Outer space has always been one of the most exciting and challenging topics, and perhaps one of the most important on the agenda of the United Nations. Nothing quite captures man's imagination like outer space.

Iran has been one of the traditional supporters of this United Nations initiative. The development of its space endeavor began decades ago, basically for civil and peaceful purposes. In that respect, it was no different from any other nation. Space technology is 'dual use', but the way in which it is applied is a matter of choice. We must pave the way for desirable applications and place limitations on uses that are undesirable. It makes sense at the national and global levels to pursue every option for the welfare, wellbeing and sustainable development of humanity. But this requires not only people who possess a high degree of expertise, capability and knowledge of the subject, but also visionary national leaders to drive such endeavors to their objectives.

Although Iran's civilian space industry and program clearly has much to say, it must be noted that the amount of funding allocated by the government to the space industries for the purpose of national security is considerably greater than its investment in civilian space industries. This has in turn led to the establishment of related industries under the management and control of the non-civilian sector. It is also evident that much effort is expended on developing transportation systems to gain independent access to space. In contrast, the civilian sector focuses on developing satellite communications, remote sensing applications, and navigation systems to improve the quality of life of the people. To attain the position that it deserves in the global arena, and for its own wellbeing, Iran has relied upon its human resources as well as the expertise and knowledge achieved

continuously in the course of enthusiastic experiments and experiences in using space for peace and prosperity. It has developed its program to deliver space-related applications services to the nation. These advances could potentially provide a motivation for productive cooperation in space between Iran and the international community. After all, Iran's space endeavor will continue to require expertise, competence, and informed and effective management. In particular, it will require the contribution of the immense resource of an enthusiastic younger generation.

In the final chapter of their book *Emerging Space Powers*,[1] the authors said in relation to Iran's space program that it was ambiguous and its foreign critics were likely to see it in terms of national prestige, missile development, and the legitimization of the regime. However, Iran was clearly much more than that. Actually it was apparent that investments in the space program were merely part of a sustained investment in applications, communications, engineering, and technology. Nevertheless, in some ways it is indeed ambiguous. There have been administrative, management, and vision-related hurdles that have influenced both pace and success. Like in other careers and fields, there have been good and noble people who improved the quality of the Iranian space endeavor and drove it towards success. On the other hand, incompetent, non-expert and poorly qualified players in different phases and fields of the endeavor have become involved, in some cases for personal interest, whose actions have impaired progress. Over a period of decades, the nation in general, and the space endeavor in particular, were harmed by an ambiguity in strategy and poor management. A lack of efficient and wise legislation on space-related issues has worsened this situation considerably. It calls to mind the allegory of 'A grin without a cat' as narrated by Lewis Carroll in *Alice's Adventures in Wonderland*. When she sees the Cheshire cat vanishing quite slowly, beginning with the end of its tail and ending with the grin, Alice thinks, 'Well! I have often seen a cat without a grin, but a grin without a cat! It's the most curious thing I have ever seen in my life!' Alice thinks back to the talk she had with the cat, when she was startled to see it sitting on a bough of a tree in the forest. The cat only grinned when it saw Alice. It looked good-natured, but Alice knew that it still had very long claws and a great many teeth. Treating it with respect, she asked, 'Would you tell me, please, which way I ought to go from here?' The cat replied, 'That depends a good deal on where you want to get to.' Alice said, 'I don't much care where.' The cat told her, 'Then it doesn't matter which way you go.' But Alice explained, 'So long as I get somewhere.' The Cheshire cat then replied, 'Oh, you're sure to do that, if you only walk long enough.'[2]

2

From air into space: formation of infrastructures

The way into space passes through the atmosphere that surrounds planet Earth. Before we developed the tools and facilities to enable us to venture into space an immense effort, time, energy and financial resource was expended by a large number of enthusiastic people around the globe to overcome gravity to float in the air in balloons and fly in 'heavier than air' machines. Since the early days of mankind, the sky has been the source of many unknown and strange things, the origin of hopes and fears. The rain and snow that fall from the clouds are sometimes pleasant, making the surroundings and nature fresh. Rain turns the landscape green and promotes crops, but sometimes it causes floods, destruction of homes, and other damage and loss of life. The Sun shines in the sky, moving from east to west on a daily basis, raising the spirits of people, but when its rays are too strong it, too, can cause harm. Mankind realized early on that both good and bad things originate in the sky, blessings and disasters. On clear nights, man became aware of various wonderful and puzzling things such as the Moon, the bright points that remain fixed relative to one another, which we now know to be stars, and those that move relative to that background in the form of planets, comets, meteors. It was realized that the dark night sky was in some sense beyond the blue sky of daytime. Where did it end? Were these entities in the sky located on nested celestial spheres which had the Earth at their center? Or did they travel in a vast and otherwise empty space? And how did this relate to Heaven? The nature of the sky was one of the ancient mysteries.[3]

The eye-catching contribution of the Iranians in this connection is undeniable. Flying into space is a common theme of mythology that manifests itself in religions in terms of Heaven.[4,5] Our interest in flying may have originated when prehistoric peoples observed birds doing so. In the myths of Persia, India, and Egypt, a bird is replaced by a magic carpet or a mythological flying rug that would rapidly transport the persons who were on it to their chosen destination. One example is Solomon's rug, which is Ghaalichey-e Hazrat-e Suleiman in the Persian language. This was reputedly made of green silk and was large enough to carry Solomon's throne together with his coterie of living people standing on his right and spirits or souls on his left. The rug was shielded from the Sun by a canopy of birds, and the wind obeyed Solomon's commands in order to deliver its passengers to their destination. This legend clearly has similarities with several verses of the Holy Koran which refer to Solomon (e.g. Surah 38, Verses 33-35).[6]

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2.1 A page from *Shah-Nameh* (Book of Kings), in which Ferdowsi describes how Kay Kāvus ascends to Heaven with the aid of hungry eagles. [Fitzwilliam Museum]

There are frequent references in Iranian mythology to flying, the most popular being the flights of two Iranian mythical kings Kay Kāvus and Jamshid, and the Iranian hero Rustam.[7] For example, Kay Kāvus ascended into the sky with the aid of hungry eagles. This was described by the highly revered Persian poet Hakim Abul Ghasim Ferdowsi-e Tusi (940-1020)[8] in his magnificent masterpiece *Shah-Nameh* (Book of Kings) which is the national epic of Iran and the Persian-speaking world.[9]

By studying the phenomena of the sky, mankind has developed astronomy, physics, mathematics, art, and literature.[10,11] There are many examples of interest in space in the works of Iranian scholars and poets.[12,13] Scientific and technical progresses over the centuries made it possible to develop the tools with which to overcome gravity and experience for ourselves the joy of floating and traveling in the atmosphere. By the advent of the industrial revolution, aeronautics was underway. It was difficult, but the will to succeed was overwhelming and experiments revealed solutions. For the Iranian society that witnessed the rapid changes in science and technology, progress and advancements in relation to aeronautics were dazzling and wonderful. In order to share in this venture, Iran sent its

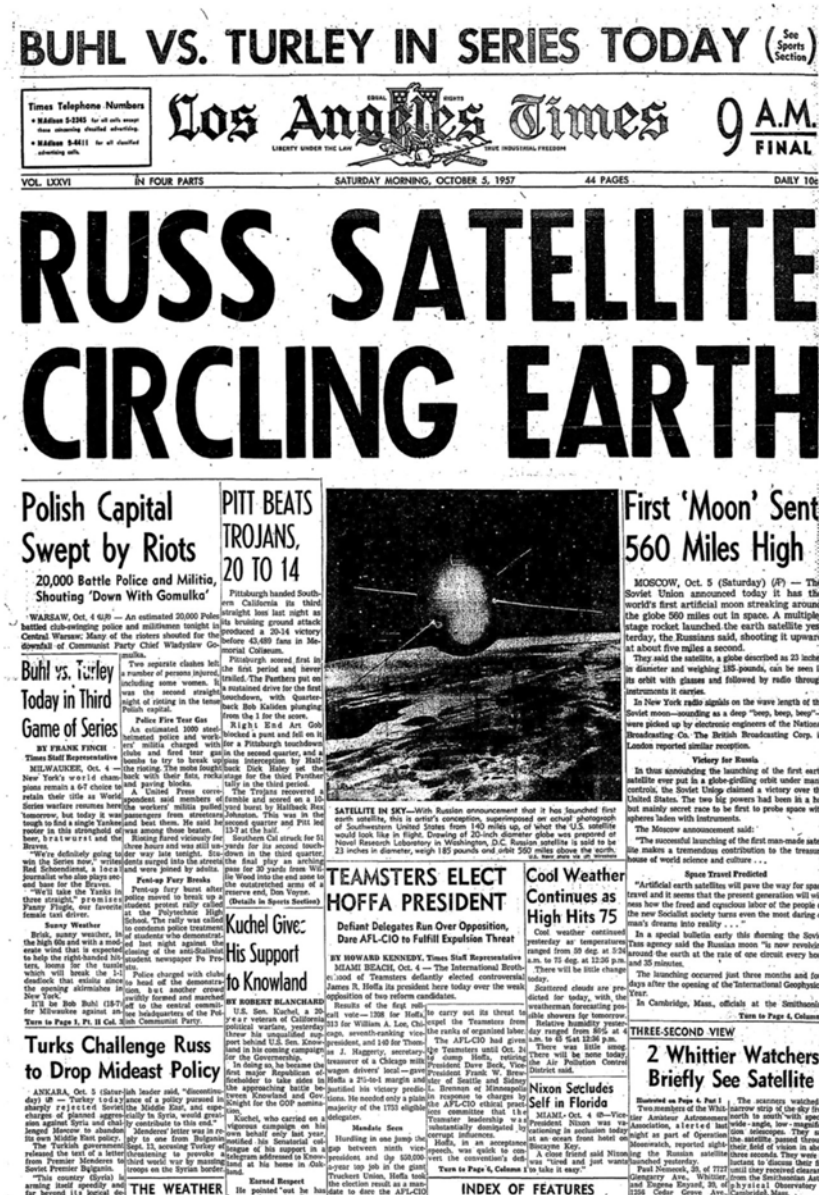
talented elites abroad to learn the technology and its engineering aspects, and began to create its own aeronautical facilities. The initial focus was on the technology of aeronautics and the benefits that it could bring, but it was also essential to understand the fundamentals of the science. Over the course of the years, the construction of engineering and educational facilities provided an indigenous infrastructure for aeronautics.

But the sky continued to beckon and the next milestone was to ascend above the atmosphere into 'outer space', a realm of vacuum and weightlessness where aeronautics does not apply. But as usual, solutions were found and gave rise to the science of astronautics. The first success was achieved on October 4, 1957 with the launch by the Soviet Union of the artificial satellite Sputnik, initiating the Space Age. On April 12, 1961 Yuri Gagarin became the first human being to launch into space and circle the globe during a 108 minute flight in a spaceship named Vostok.

Those great and wonderful events ignited great enthusiasm in Iran. When, one year later in 1958, the United Nations decided to launch a plan for international cooperation in space, Iran, as a member nation, was enthusiastic. Reportedly, Shah Muhammad Reza Pahlavi was supportive of the peaceful uses of space and Iran's participation in the ad-hoc Committee on International Cooperation in Outer Space that was established by the United Nations, subsequently to be renamed the Committee on the Peaceful Uses of Outer Space (COPUOS). Iran signed up to and/or ratified four UN Treaties on space and also ratified four international agreements relating to activities in outer space, including the treaty that bans nuclear tests in outer space.[14] In the 1970s Iran eagerly sought to apply space technologies in different fields, in particular communications, broadcasting, and Earth observation. The fact that Iran was ready to establish its space agency in 1977 is evidence of the country's intention to institutionalize space activities.

As with aeronautics, in order to benefit from developments in space Iran needed to build up an infrastructure that combined educational and technological facilities. Some institutions and entities were established or commissioned to take responsibility for handling and coordinating space-related issues. To attract early expertise and assist with financing, international cooperation was an effective solution. Inevitably, non-civilian entities became involved. As with aeronautics, Iran was fortunate enough to draw upon the support of the more advanced spacefaring countries in addressing its ever increasing requirements. But the Iranian revolution in 1979 derailed this orderly program. The new revolutionary government was in conflict with the leading powers of the world, which were also the most advanced spacefaring nations. Owing to these international disputes, and shortly thereafter the onset of the war with Iraq, Iran became ever more isolated in the community of nations. As a result, international cooperation in the development and application of new technologies soon petered out. But by then Iran had its own aeronautics infrastructure, and over the years this was adapted to serve the nascent indigenous space industries by filling the technological gaps caused by the international sanctions and bans imposed on Iran.

Starting with the Fourth Five-Year Development Plan (2004-2010), the Iranian government called for further development of the aerospace industry. Indeed, aerospace would receive top priority in the General National Scientific Plan which was established in 2010. This document specified the goals, objectives, and quantitative indicators by which to judge the success of the strategies for developing these technologies.



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RUSS SATELLITE CIRCLING EARTH

Polish Capital Swept by Riots

20,000 Battle Police and Militia, Shouting 'Down With Gomulka'

WARSAW, Oct. 4 (UP) — An estimated 20,000 Poles battled club-swinging police and militiamen tonight in Central Warsaw. Many of the rioters shouted for the downfall of Communist Party Chief Wladyslaw Gomulka.

Two separate clashes left a number of persons injured, including some women. It was the second straight night of rioting in the tense Polish capital.

Police Fire Tear Gas

An estimated 1000 steel-helmeted police and workers' militia charged with clubs and fired tear gas bombs to try to break up the rioting. The mobs fought back with their fists, rocks and paving blocks.

A United Press correspondent said members of the workers' militia pulled passengers from streetcars and beat them. He said he saw among those beaten.

Rioting flared viciously for three hours and was still under way late tonight. Students surged into the streets and were joined by adults.

Pen-up Fury Breaks

Pent-up fury burst after police moved to break up a student protest rally called at the Polytechnic High School. The rally was called to condemn police treatment of students who demonstrated last night against the closing of the anti-Stalinist student newspaper Po Prostu.

Police charged with clubs in head of the demonstration, but another crowd swiftly formed and marched off to the central committee headquarters of the Polish Communist Party.

Turn to Page 3, Pt. II Col. 3

Buhl vs. Turley Today in Third Game of Series

BY FRANK FINCH
Times Staff Representative

MILWAUKEE, Oct. 4 — New York's world champions remain a 6-7 choice to retain their title as World Series warfare resumes here tomorrow, but today it was tough to find a single Yankee rooter in this stronghold of beer, bratwurst and the Braves.

"We're definitely going to win the Series now," writes Red Schoendienst, a local journalist who also plays second base for the Braves.

"We'll take the Yanks in three straight," promises Fanny Flagle, our favorite female taxi driver.

Sunny Weather

Brisk, sunny weather, lots of high fills and with a modest wind that is expected to help the right-handed hitters, looms for the tussle which will break the 1-1 deadlock that exists since the opening skirmishes in New York.

It'll be Bob Buhl (18-7) for Milwaukee against one

Turn to Page 3, Pt. II Col. 3

PITT BEATS TROJANS, 20 TO 14

Pittsburgh handed Southern California its third straight loss last night as its bruising ground attack produced a 20-14 victory before 43,489 fans in Memorial Coliseum.

Pittsburgh scored first in the first period and never trailed. The Panthers put on a sustained drive for the first touchdown, with Quarterback Bob Kalsden plunging from the 1 for the score.

Right End Art Goble hooked a punt and fell on it for a Pittsburgh touchdown in the second quarter, and an interception by Halfback Dick Haley set the stage for the third Panther tally in the third period.

The Trojans recovered a fumble and scored on a 10-yard burst by Halfback Rex Johnson. This was in the second quarter and Pitt led 13-7 at the half.

Southern Cal struck for 51 yards for its second touchdown in the third quarter, the final play an arching pass for 20 yards from Willie Wood into the end zone to the outstretched arms of a reserve end, Don Voyne.

(Details in Sports Section)

SATELLITE IN SKY—With Russian announcement that it has launched first earth satellite, this is artist's conception, supervised by scientists of Southwestern United States from 140 miles up, of what the U.S. satellite would look like in flight. Drawing of 20-inch diameter globe was prepared at Naval Research Laboratory in Washington, D.C. Sputnik is said to be 23 inches in diameter, weigh 185 pounds and orbit 560 miles above the earth.

First 'Moon' Sent 560 Miles High

MOSCOW, Oct. 5 (Saturday) (AP) — The Soviet Union announced today it has the world's first artificial moon streaking around the globe 560 miles out in space. A multiple-stage rocket launched the earth satellite yesterday, the Russians said, shooting it upward at about five miles a second.

They said the satellite, a globe described as 23 inches in diameter and weighing 185 pounds, can be seen in its orbit with glasses and followed by radio through instruments it carries.

In New York radio signals on the wave length of the Soviet moon—sounding as a deep "beep, beep, beep"—were picked up by electronic engineers of the National Broadcasting Co. The British Broadcasting Corp. in London reported similar reception.

Victory for Russia

In thus announcing the launching of the first earth satellite ever put in a globe-girdling orbit under man's control, the Soviet Unigo claimed a victory over the United States. The two big powers had been in a hot but mainly secret race to be first to probe space with spheres laden with instruments.

The Moscow announcement said:

"The successful launching of the first man-made satellite makes a tremendous contribution to the treasure house of world science and culture . . .

Space Travel Predicted

"Artificial earth satellites will pave the way for space travel and it seems that the present generation will witness how the freed and capacious labor of the people of the new Socialist society turns even the most daring of man's dreams into reality . . ."

In a special bulletin early this morning the Soviet Tass agency said the Russian moon "is now revolving around the earth at the rate of one circuit every hour and 35 minutes.

The launching occurred just three months and four days after the opening of the International Geophysical Year.

In Cambridge, Mass., officials at the Smithsonian

Turn to Page 4, Column 1

TEAMSTERS ELECT HOFFA PRESIDENT

Defiant Delegates Run Over Opposition, Dare AFL-CIO to Fulfill Expulsion Threat

BY HOWARD KENNEDY, Times Staff Representative

MIAMI BEACH, Oct. 4 — The International Brotherhood of Teamsters defiantly elected controversial James R. Hoffa its president here today over the weak opposition of two reform candidates.

Results of the first roll-call vote — 1208 for Hoffa, 313 for William A. Lee, Chicago, seventh-ranking vice president, and 140 for Thomas J. Haggerty, secretary-treasurer of a Chicago milk wagon drivers' local — gave Hoffa a 2½-to-1 margin and justified his victory predictions. He needed only a plain majority of the 1753 eligible delegates.

Mandate Seen

Hurdling in one jump the gap between ninth vice president and the $50,000-a-year top job in the giant Truckers Union, Hoffa took the election result as a mandate to force the AFL-CIO to carry out its threat to expel the Teamsters from the ranks of organized labor.

The AFL-CIO had given the Teamsters until Oct. 24 to dump Hoffa, retiring President Dave Beck, Vice-President Frank W. Brewster of Seattle and Sidney P. Brennan of Minneapolis in response to charges by the AFL-CIO ethical practices committee that the Teamster leadership was substantially dominated by corrupt influences.

Hoffa, in an acceptance speech, was quick to convert the convention's de-

Turn to Page 6, Column 1 to take it easy."

Cool Weather Continues as High Hits 75

Cool weather continued yesterday as temperatures ranged from 59 deg. at 5:24 a.m. to 75 deg. at 12:36 p.m.

There will be little change today.

Scattered clouds are predicted for today, with the weatherman forecasting possible showers for tomorrow.

Relative humidity yesterday ranged from 86% at 4 a.m. to 45 at 12:36 p.m.

There was little smog. There will be none today, the Air Pollution Control District said.

Nixon Secludes Self in Florida

MIAMI, Oct. 4 (AP)—Vice-President Nixon was vacationing in seclusion today at an ocean front hotel on Biscayne Key.

A close friend said Nixon was "tired and just wants

Kuchel Gives His Support to Knowland

BY ROBERT BLANCHARD

U.S. Sen. Thomas Kuchel, a 20-year veteran of California political warfare, yesterday threw his unqualified support behind U.S. Sen. Knowland in his coming campaign for the Governorship.

In doing so, he became the first major Republican officeholder to take sides in the approaching battle between Knowland and Governor Knight for the GOP nomination.

Kuchel, who carried on a vigorous campaign on his own behalf only last year, notified his Senatorial colleague of his support in a telegram addressed to Knowland at his home in Oakland.

Earned Respect

He pointed "out he has known the senior Senator for more than 20 years and has served with him in both the State Legislature and the U.S. Senate.

He also noted Knowland is known for the respect he has earned among members of both parties in Congress.

"In my view," he declared,

Turn to Page 7, Column 3

Turks Challenge Russ to Drop Mideast Policy

ANKARA, Oct. 5 (Saturday) (AP) — Turkey today sharply rejected Soviet charges of planned aggression against Syria and challenged Moscow to abandon its own Middle East policy.

The Turkish government released the text of a letter from Premier Menderes to Soviet Premier Bulganin.

"This country (Syria) is arming itself speedily and far beyond its logical defensive needs," Menderes said.

"Or rather it perhaps is being turned into an armament depot eventually to be used by others.

"If establishment of the true friendship based on mutual trust between our two countries is desired, as you in your message," the Turk-

ish leader said, "discontinuance of a policy pursued in the Middle East, and especially in Syria, would greatly contribute to this end."

Menderes' letter was in reply to one from Bulganin Sept. 13, accusing Turkey of threatening to provoke a third world war by massing troops on the Syrian border.

THE WEATHER

No smog today.

U.S. Weather Bureau forecast: Scattered cloudiness but mostly sunny today with high near 75. Partly cloudy and slightly cooler tomorrow with chance of showers. Yesterday's high, 75; low, 58.

$35,000 CONTEST DETAILS INSIDE

New entries in the $35,000 Pin for All contest close one week from today. Details of the competition appear on Page 8, Part 2 of today's Times.

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THREE-SECOND VIEW

2 Whittier Watchers Briefly See Satellite

Illustrated on Page 4, Part 1

Two members of the Whittier Amateur Astronomers Association, alerted last night as part of Operation Moonwatch, reported sighting the Russian satellite launched yesterday.

Paul Hancock, 20, of 7727 Glengarry Ave., Whittier, and Eugene Enyard, 20, of 12316 Cedar Grove Ave., Whittier, said they sighted the satellite moving in a northeast to southwest direction about 8 p.m.

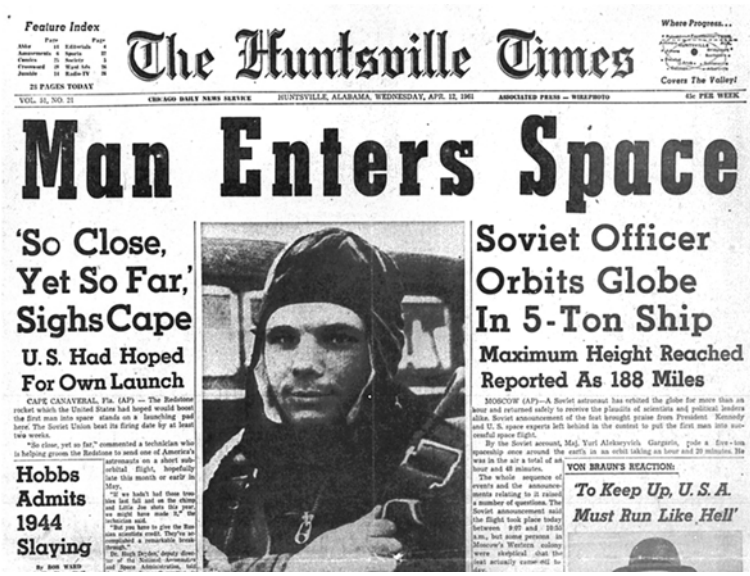
The association manned 10 special satellite observing telescopes for more than three hours last night at the Whittier College Observatory on College Hill, east of the campus.

The scanners watched a narrow strip of the sky from north to south with special wide-angle, low-magnification telescopes. They said the satellite passed through their field of vision in about three seconds. They were reluctant to discuss their find until they received clearance from the Smithsonian Astrophysical Observatory at Cambridge, Mass.

Observatories at Griffith Park, Mt. Wilson and Mt. Palomar last night reported their astronomical equipment was inadequate to track the satellite.

Spokesmen said it was too close to the earth and moving too fast for large telescopes to follow in their narrow fields of vision.

2.2 The front page of the *Los Angeles Times* newspaper of October 5, 1957 announcing the successful placing of the first satellite into orbit around the Earth. [*Los Angeles Times*]



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The Huntsville Times

Where Progress...

Covers The Valley!

21 PAGES TODAY

VOL. 81, NO. 21 — CHICAGO DAILY NEWS SERVICE — HUNTSVILLE, ALABAMA, WEDNESDAY, APR. 12, 1961 — ASSOCIATED PRESS — WIREPHOTO — 15c PER WEEK

Man Enters Space

'So Close, Yet So Far,' Sighs Cape

U.S. Had Hoped For Own Launch

Hobbs Admits 1944 Slaying

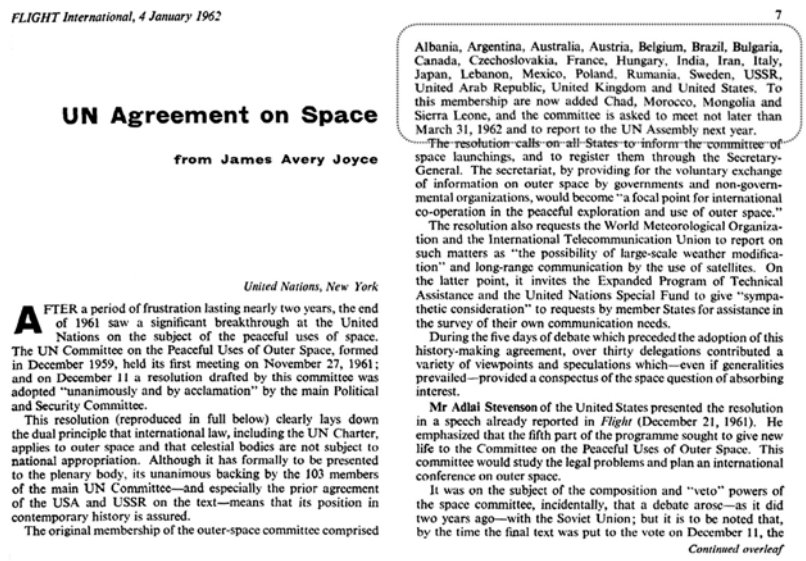
Soviet Officer Orbits Globe In 5-Ton Ship

Maximum Height Reached Reported As 188 Miles

VON BRAUN'S REACTION:

To Keep Up, U.S.A. Must Run Like Hell'

2.3 'Man Enters Space' was the headline of *The Huntsville Times* on April 12, 1961 after Yuri Gagarin became the first man to orbit the Earth in a spaceship named Vostok. [*The Huntsville Times*]



FLIGHT International, 4 January 1962

7

UN Agreement on Space

from James Avery Joyce

United Nations, New York

AFTER a period of frustration lasting nearly two years, the end of 1961 saw a significant breakthrough at the United Nations on the subject of the peaceful uses of space. The UN Committee on the Peaceful Uses of Outer Space, formed in December 1959, held its first meeting on November 27, 1961; and on December 11 a resolution drafted by this committee was adopted "unanimously and by acclamation" by the main Political and Security Committee.

This resolution (reproduced in full below) clearly lays down the dual principle that international law, including the UN Charter, applies to outer space and that celestial bodies are not subject to national appropriation. Although it has formally to be presented to the plenary body, its unanimous backing by the 103 members of the main UN Committee—and especially the prior agreement of the USA and USSR on the text—means that its position in contemporary history is assured.

The original membership of the outer-space committee comprised Albania, Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Czechoslovakia, France, Hungary, India, Iran, Italy, Japan, Lebanon, Mexico, Poland, Rumania, Sweden, USSR, United Arab Republic, United Kingdom and United States. To this membership are now added Chad, Morocco, Mongolia and Sierra Leone, and the committee is asked to meet not later than March 31, 1962 and to report to the UN Assembly next year.

The resolution calls on all States to inform the committee of space launchings, and to register them through the Secretary-General. The secretariat, by providing for the voluntary exchange of information on outer space by governments and non-governmental organizations, would become "a focal point for international co-operation in the peaceful exploration and use of outer space."

The resolution also requests the World Meteorological Organization and the International Telecommunication Union to report on such matters as "the possibility of large-scale weather modification" and long-range communication by the use of satellites. On the latter point, it invites the Expanded Program of Technical Assistance and the United Nations Special Fund to give "sympathetic consideration" to requests by member States for assistance in the survey of their own communication needs.

During the five days of debate which preceded the adoption of this history-making agreement, over thirty delegations contributed a variety of viewpoints and speculations which—even if generalities prevailed—provided a conspectus of the space question of absorbing interest.

Mr Adlai Stevenson of the United States presented the resolution in a speech already reported in *Flight* (December 21, 1961). He emphasized that the fifth part of the programme sought to give new life to the Committee on the Peaceful Uses of Outer Space. This committee would study the legal problems and plan an international conference on outer space.

It was on the subject of the composition and "veto" powers of the space committee, incidentally, that a debate arose—as it did two years ago—with the Soviet Union; but it is to be noted that, by the time the final text was put to the vote on December 11, the

Continued overleaf

2.4 A page from the weekly magazine *Flight International* dated January 4, 1962, reporting on the efforts of the United Nations on the peaceful uses of space. It refers to the original membership of the outer space committee, which includes Iran. [*Flight International Magazine*]

Aerospace encompasses the science of the Earth's atmosphere and the vacuum of outer space, and deals in particular with the technologies of aerodynamic flight and space travel. It currently includes some of the most advanced research subjects and attracts large research and development funds from both civilian and non-civilian sources. This research boosts progress in other aspects of engineering because aerospace is a multidisciplinary topic that applies physics, mechanics, materials science and metallurgy, computer science, electronics, and so on. This chapter will address the establishment and development of the entities and organizations that are active in aerospace. A considerable number of them were founded prior to the Space Age in order to accommodate the needs of aeronautics.

2-1 AERONAUTICS, THE RUNWAY FOR DEPARTURE TO SPACE

In discussing the Iranian space endeavor, it is difficult to separate the air and space aspects because they are tightly linked. Astronautics is actually an extension of aeronautics and complementary to it, so there is no clear separation between them. Let us see how advances in aeronautics allowed Iran to expand its activities into space.

2-1-1 Early developments of aeronautics

Iranian dreams of flying were first realized by sending two unmanned balloons into the sky in Tehran and another similar balloon in Tabriz during the reign of Naser al-Din Shah (1848-1896), who was the fourth king of the Ghajar dynasty which ruled prior to the Pahlavi dynasty.[15] There are reports in the newspaper *Vaghaye-e Ettefaghyeh* of the Dar ol-Fonoon Academy of Learning (or simply the Dar ol-Fonoon, standing for polytechnic in the Persian language) producing hydrogen gas in order to carry balloons aloft. Dar ol-Fonoon was Iran's first academy of education and training to be established in the Western Europe style. It was founded in 1849 by Mirza Taghi Khan-e Farahani (1807-1852), one of Iran's greatest reformist statesmen, better known as Amir Kabir. In his diary, Nasser al-Din Shah describes witnessing the first flight of two balloons in Tehran, both occurring on the same day in 1877.[16] Late in 1913, the people of Tehran for the first time saw an airplane flying over the city. All across the city, astounded people rushed outside to get a closer look at the strange bird. The airplane landed in the city center at an army exercise field, then known as Meidan-e Mashgh in the Persian language. On landing, it was slightly damaged when it nudged the barrel of a cannon on the ground. This airplane, a Bleriot XI, was flown into Tehran from Russia by a Russian pilot. The aircraft was repaired with the assistance of Iranian army technicians and then it flew back to Russia.[17]

In more recent times, Iran's commitment to developing the infrastructure for its aviation industry dates from the 1930s, when it was initiated by Shah Reza Pahlavi with the assistance of the Junkers aviation company in Germany. Aviation was further expanded in Iran in the 1970s during the reign of Shah Muhammad Reza Pahlavi, who not only ordered a large quantity of the most advanced weapons produced by the Unites States but also attempted to acquire the capability to manufacture those arms indigenously.

2.5 In 1877 Tehran residents gather to watch the landing of a balloon for the first time in Iran. [Wikipedia]

Bell Helicopter, a division of Textron, Inc., built a factory in Isfahan to produce Model-214 helicopters and Northrop partnered with Iran Aircraft Industries, Inc., to maintain many of the US military aircraft that Iran purchased. The Iranian company was expected to go on to produce aircraft components and eventually complete planes.[18]

Commercial development of the aviation industry in Iran started even earlier, with the creation in 1923 of the first airline office in Tehran in cooperation with Junkers. It ran air travel services between Tehran, Mashhad, Shiraz, Bandar Anzali, and Bushehr. Shah Reza Pahlavi initiated the establishment of a non-civilian body in 1922 as the first official aviation organization in Iran.

Although the initiatives for the development of the aviation industry in Iran were commercial at the outset, in the 1930s the authorities decided to develop this important new industry both for civilian and non-civilian means. The airlines started their services in Iran in 1923, in parallel with the non-civilian developments. The implementation of civil aviation services required the establishment of technical and civil supporting

2.6 Colonel Muhammad Taghi Pesyan (1892-1921), born in Tabriz, was a popular military leader of Iran and the first Iranian to successfully pilot an aircraft. He was the commander of Gendarmerie in 1915, and wrote two books in the Persian language *Sargozasht-e yek javan-e vatan-doust* (The Story of a Young Patriot) and *Jang-e Moghaddas az Baghdad ta Iran* (The Sacred War from Baghdad to Iran). [Wikipedia]

organizations alongside the non-civilian services and logistics. The rapid pace of development resulted in a partnership between the private sector and Iran Airways in 1944 by Iranian private investment. The next in this group was the Persian Air Service (PAS), which began operating in 1952. Iran Airways and the Persian Air Service merged as Iran Airline in 1961. In 1962 state nationalization of the air transportation industry established the Iranian National Airline (called Homa in the Persian language) to operate under the regulations imposed by the International Air Transport Association (IATA). Over the ensuing years, the number of active air agencies grew to 13 with 120 airliners. Homa and Iran Air Tour were both state air agencies and Aseman was operating as a semi-state agency.

In his 2007 book *Tarikhchey-e Havapeymai-e Bazargani dar Iran az Aghaz ta Emrooz* (The History of Iranian Commercial Aviation from the Beginning to the Present Day),

Abbas Atrvash, one of the most distinguished managers of the air transportation and airline industry in Iran, divided it into eight periods:

1923-1927:	Iranian Air Force
1927-1932:	Junkers Airlines in Iran
1932-1938:	Absence of commercial air transport
1938-1946:	The airline of the Ministry of Post, Telegraph and Telephone (MPTT) or 'Iranian State Airlines'
1945-1961:	Iranian Airways and Persian Air Services
1961-1962:	United Iranian Airlines
1962-1979:	Iran National Airlines (Iran Air), the flourishing years
1979-Present:	Post-revolution, the era of multiple airlines.

2-1-2 Foundation of the Iranian Air Force

As elsewhere, Iran's air force played a key role in the early formation of the country's commercial air transportation. The first Iranian passengers were actually carried by air force planes. In addition to the civilian passengers, air force planes were also performing services to meet some public needs, such as medical relief, and carrying postal packages and items of freight. In the early stages of the commercial airlines, some of the pilots were active air force officers. In later years many of the airline pilots were former air force pilots. Prior to the establishment of a national airline, the air force officially allocated aircraft and personnel exclusively for the purpose of transporting government and military executives between Iranian cities. Nevertheless, it supported civil air transportation. Because of the contribution of Iran's air force in providing civilian air services it is fair to say that the history of air transportation in Iran was initiated by the air force that was established prior to commercial aviation. The Iranian Air Force later became the Imperial Iranian Air Force. After the revolution in 1979 that ended the Pahlavi dynasty, the country's air force continued its activity under the new regime.

In February 1921 when Reza Khan led the coup d'état that ended the Ghajar dynasty after a reign of 131 years, he came to power as the commander of the armed forces. Later, as Reza Shah, he assigned a small office in the military headquarters in Tehran to investigate the feasibility of creating a national air force, even though the military had neither aircraft nor pilots. The mission of acquiring aircraft got underway in 1922, when the government of Iran approached that of the United States to negotiate the purchase of American military aircraft and the training of pilots and technicians. But this request was rejected owing to commitments to peace treaties, which the USA had signed with other countries. Iran therefore made approaches to Germany, the Union of Soviet Socialist Republics (USSR), France, and later Great Britain. Finally, one German-made Junkers-F13 was bought and delivered to Iran. Later in 1923, a shortage of government finance prompted people in the Gilan and Mazandaran provinces to donate the funds to enable the government to purchase two more Junkers-F13 aircraft, which were named after these two provinces in appreciation. Between 1923 and 1925 a number of aircraft from a variety of countries were added to the nascent Iranian Air Force, including British-Soviet De Havilland Avro 504K (or Avroshka), and French Spad-42, Breguet-14 and -19 and Potez-8 models. However, in spite of the fast growing fleet, Iran's air force still did not have its

2.7 Colonel Ahmad Nakhchivan (1893-1966), born in Tehran, was the first commander-in-chief of the Iranian Air Force. In June 1923 he was dispatched to France under the program for air force pilots and technicians to train as a member of the first group of officers. On finishing his training he took off from Paris on one of the Iranian Breguet-19 airplanes marked with the flag and logo of Iran, and landed at Ghaleh Morghi airfield on February 25, 1925. [Wikipedia]

own pilots to fly them. Following the purchase of aircraft from France and the USSR, both of these nations were chosen to train Iran's air force pilots and technician. In June 1923 the first group of officers was dispatched to France to receive training, and the following year another group of officers was sent to the USSR.

Despite its humble beginnings in 1921 as a small department of the army, the Iranian Air Force became one of the world's outstanding, well-equipped and technologically advanced air forces. It had a large fleet of sophisticated fighter aircraft, military transports and other specialized aircraft, and was staffed by an exceptional group of highly qualified officers, pilots and technicians.[19]

2.8 Iran's Junkers-F13 aircraft. [Iranian Chamber Society]

2-1-3 Activity of Junkers Luftverkehr Persien

On February 8, 1927, Junkers officially initiated Iran's first biweekly scheduled passenger air service from Tehran to Bandar Pahlavi (currently Bandar Anzali) in the north of Iran, and biweekly flights to Ghasr-e Shirin at the western border of the country. This marked a milestone in the history of Iranian commercial aviation. At that time, when air transportation was in its early stages of development and air travel was still a novelty in Europe and the USA, operating scheduled air services in Iran was a considerable achievement. When the Junkers air services started in Iran, the railways system was still under construction. With the airways developing more rapidly than the railways, they readily proved their worth.

The Junkers company was created in Germany in 1895 to manufacture thermodynamic products. However, in 1915 it produced its first aircraft, the Junkers-1. In February 1922, under an agreement signed with the newly formed USSR, the company began its activity in the Soviet Union, going on to form the Junkers Luftverkehr Russia (Junkers Airlines in Russia) to undertake air transport services. When the Soviet Union initiated its own airlines in 1924, Junkers terminated its activity in the USSR and switched its attention to Persia, the name by which Iran was known at that time. In September 1924, Junkers contacted the Iranian government with a proposal to operate postal services between Baku and Bandar Pahlavi. While the proposal was under review by the Iranian government, Junkers started experimental non-scheduled flights between Tehran and Baku in Azerbaijan, taking advantage of previously granted traffic rights. The first flight took place on December 20, 1924, and the project ran to March 1925. The next year, Junkers signed a 5-year agreement with the Persian government to establish an airline to provide air services within Persia, and this company was registered as Junkers Luftverkehr Persien (Junkers Airlines in Iran). The company operated Junkers-F13 aircraft, a single-engine type that was capable of 160kph and was a popular commercial aircraft at that time. It carried two pilots and four passengers. The first services were launched in two directions, one from Tehran to Bandar Pahlavi and the other one from Tehran to Ghasr-e Shirin via Hamadan and Kermanshah. In February 1928, the northbound route was extended to Baku and the westbound route to

Baghdad in Iraq. Later, three more services were added: a southwest route to Bushehr via Isfahan and Shiraz, a northeast service to Mashhad, and a northwest route to Tabriz via Ghazvin. Between 1927 and 1932, Junkers played the role of a small internal and regional airline, carrying a considerable number of passengers and a large amount of cargo and mail. It also flew weekly services from at least ten cities in Iran to Baku, Baghdad and Kabul in Afghanistan, and arranged for the first time for the Iranian airmail to be carried from London, Paris, Vienna (via Berlin), and Moscow to Baku, and from Baku to Iran by its own airplanes.[20]

2-1-4 State airline substitutes Junkers

Junkers Luftverkehr Persien was the only civilian air transportation and commercial air service to operate in Iran between 1932 and 1938, when the government formed a national airline. However, the Iranian Air Force occasionally carried mail and civilian passengers, particularly government officials and employees. From its inception, the Ministry of Post, Telegraph and Telephone (MPTT) – which in 2003 became the Ministry of Communications and Information Technology (MCIT) – was Iran's only national entity for the carriage of airmail. MPTT became involved in air transportation in 1924, when the airmail service was first started in Iran, before Junkers initiated its services in Iran. The ministry often operated non-regular flights using air force aircraft to distribute mail across the country. By the time that Junkers ceased its operations in Iran, the government had in place a plan for MPTT to use airplanes that would be handled, maintained and flown by the Iranian Air Force. Two De Havilland DH-89s (also known as 'Dragon Rapid') were purchased, and this fleet was later increased to four aircraft. This twin-engine model was capable of carrying up to eight passengers, and it was initially operated between Tehran and Baghdad. Thus MPTT organized the 'Iranian State Airlines'. It began scheduled services on March 15, 1938 by running once a week on the Tehran-Kermanshah-Baghdad route. Later, another service between Tehran, Isfahan, Shiraz, and Bushehr was added. This airline also carried passengers on its regular airmail flights. This operation provided valuable service during World War II. Although the Iranian State Airline performed limited operations, with a small number of aircraft, it did an efficient and productive job until its services were reassigned to a new company named Iranian Airways on April 6, 1946.[21]

2-1-5 Private airlines and 'aero-*preneurs*'

In December 1944 a number of influential and affluent Iranian investors led by Reza Afshar (1887-1964) established Iranian Airways as a private company. Afshar, a prominent politician and shrewd businessman, had already helped to set up Iran Tour, the first Iranian travel and tourism organization. The other active partner in this new airline was Gholam Hussein Ebtehaj, a former mayor of Tehran. He simultaneously served as the managing director of both Iran Tour and Iranian Airways. The most senior manager at Iranian Airways was Houshang Tajadod, an icon of the Iranian airline industry to 1982. Iranian Airways signed an agreement with Trans World Airlines (TWA) in the United States for technical assistance in return for 10% of its shares. When this agreement ended, the French company of Cie General de Transport (CGT) stepped in. Next in line was the American company Trans Ocean Airlines (TOA), whose contract concluded in 1961 when the airline was nationalized.

2.9 Reza Afshar (1887-1964), an influential and affluent Iranian investor and aero*preneur*, a prominent politician, and a shrewd businessman who was also the main founder of Iran Tour and Iranian Airways. Born in Urmieh, he studied political economy and public finance in the USA and was the Minister of Roads, a member of parliament and the governor of several provinces. [Iranian Chamber Society]

2.10 Gholam Hussein Ebtehaj (1897-1967), managing director of Iran Tour and Iranian Airways. Born in Rasht, he was educated in France, Lebanon, and Iran, and served as the mayor of Tehran and the parliament member. [Iranian Chamber Society]

2.11 Houshag Tajadod (1920-2010), an icon of the Iranian airline industry and a pioneer and the most senior and qualified management member at Iran Air. [*Tarikhchey-e Havapeymai-e Bazargani dar Iran az Aghaz ta Emrooz* (The History of Iranian Commercial Aviation from the Beginning to the Present Day]

By the end of March 1945, Iranian Airways had added three US-surplus military C-47s to its fleet. Also known as the DC-3 Dakota, this was a type of transport aircraft introduced during World War II. Iranian Airlines went on to purchase a total of 20 of these airplanes. The first scheduled flights started from Tehran to Mashhad and were followed by Tehran to Isfahan, Shiraz, Bushehr, Abadan, Ahwaz, and limited flights to Zahedan. When Iranian Airways started to operate international flights, its first destinations were Cairo and Baghdad. Beirut and Tel Aviv were added in 1946. Following the start of the internal and regional flights in the early years after World War II, Iranian Airways introduced an international flight to Paris via Beirut and Athens, and in April 1947 it opened its first office outside Iran in Paris. Prior to 1946, most of the pilots and technical personnel of Iranian Airways were from the USA, where the aircraft originated. After that, the Iranian Air Force assigned some of its pilots to fly with Iranian Airways. In addition, civilian pilots who were trained at the Iranian Aero Club joined Iranian Airways. The first three women pilots Effat Tejaratchi (1917-1999), Ina Afshid (1921-2005) and Sadigheh Dowlatshahi (1915-2005) were licensed to fly at that time.

2.12 Effat Tejaratchi (1917-1999), born in Tehran, became the first Iranian female pilot in 1939. She, Sadigheh Farrokhzad Dowlatshahi (1915-2005), and Ina Afshid (1921-2005) were the three brave women pioneers of Iranian aviation. She was also a belletrist and a poet. [*Farheekhtegan Daily*]

An airline which operated at the same time as Iranian Airways was Persian Air Services (PAS). It was founded in 1954 and was predominantly a cargo carrier.

After Iran Airways had been operating for 16 years the company suffered a shortage of financial resources, failed to make upgrades, modernize its fleet, and improve its quality of service. Declining safety measures and a number of accidents prompted the government to nationalize the entire airline industry in Iran.[22]

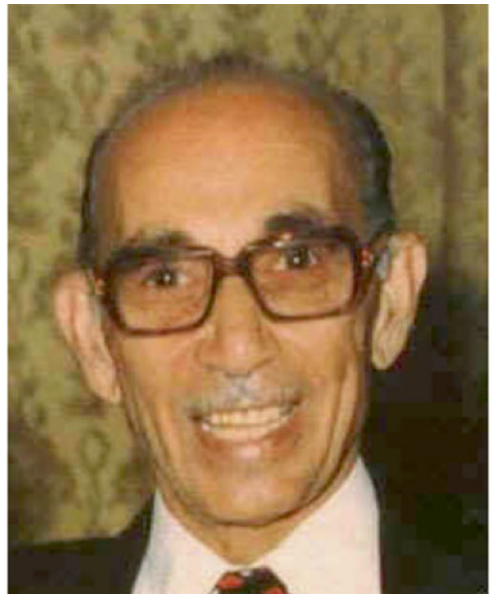
2-1-6 Nationalization of the airline industry and foundation of Iran National Airlines

As a result of the nationalization of the airline industry, in August 1961 Iranian Airways and Persian Air Services were merged as United Iranian Airlines. Then in February 1962 the new Iran National Airline Corporation (shortened to Iran Air) was founded. In the Persian language it is known as Homa after the acronym for Havapeymai-e Melli-e Iran. This took over United Iranian Airlines by acquiring all its assets, which were the combined resources of Iranian Airways and Persian Air Services. Under its able managing director, Major General Ali Muhammad Khademi, Iran Air became a world-class national air carrier and gained an undisputed international rank. Khademi will go down in history for the highest level of service to his country's aviation industry. According to Abbas Atrvash,

2.13 Major General Muhammad Amir Khatam (1920-1975), born in Rasht, was a pilot and served as Commander of the Imperial Air Force. [Wikipedia]

'General Ali Muhammad Khademi was a gifted, self-made, tireless, hard-working man and a management and leadership genius. He was an uncompromising fighter with unusual fortitude and self-confidence, who did not accept anything less than perfect. Utterly fair and honest, he possessed a strong humane spirit, an extremely light heart and wonderful sense of humor. He hated favoritism and selected his colleagues on their merit. He gave young men and women, particularly those who were not from, or related to, the privileged class unprecedented opportunities for growth.'

Iran Air was soon considered one of the most important players in the world of aviation. Known for the pace of its growth, it was an extremely well managed national and international airline. In 1970 its managing director was elected as president of the International Air Transport Association (IATA), the highest regulating entity of the international air transportation industry. Although Iran Air was a state-owned airline, it remained a profitable enterprise and its financial self-sufficiency was unprecedented in Iran as well as internationally right through to 1979. This prized reputation, which at the same time brought a number of prestigious awards and certificates for Iran Air, was not achieved easily. It firstly reflected the importance that the management placed on safety. And next it was



2.14 Major General Ali Muhammad Khademi (1913-1978), the Iranian Air Force Chief of Staff and the first managing director of the national airline Iran Air. Born in Jahrom, he was the first Iranian Air Force officer to become a licensed commercial pilot by obtaining his first rate license from the Iranian Civil Aviation Department. [*Tarikhchey-e Havapeymai-e Bazargani dar Iran az Aghaz ta Emrooz* (The History of Iranian Commercial Aviation from the Beginning to the Present Day)]

due to the efforts and endless endeavor of a group of highly educated and skilled Iranian engineers and pilots.[23]

The attention given to aeronautics and the aviation industry in Iran in the five decades following its inception in the 1930s led to the establishment of a robust infrastructure, ever increasing capacity, and the emergence of able and specialized human resources. It raised the country's rank to the strongest in the Middle East, a status that it continued to benefit from even after the revolution in Iran in 1979 and particularly during the course of the subsequent war with Iraq.

Iran can be proud of its aviation dignitaries, including its competent and avant-garde managers and personnel, and its pioneering pilots – both male and female – in particular Muhammad Taghi Pesyan (1892-1921), Ahmad Nakhchivan (1893-1966), Ali Muhammad Khademi (1913-1978), Effat Tejaratchi (1917-1999), Muhammad Amir Khatam (1920-1975), Nader Jahanbani (1928-1979), Houshag Tajadod (1920-2010), Abbas Atrvash (1937-2009), Hassan Shafti (b.1939), Akram Monfared Arya (b.1946), Mansour Sattari (1948-1993), Jalil Zandi (1951-2001), and Houshang Shahbazi (b.1956).

2.15 Major General Nader Jahanbani (1928-1979) was a pilot and became 'father' of the Iranian Air Force and the Commander of the Golden Crown of the Imperial Iranian Air Force. Born in Tehran, he played a crucial role in the Iranian Air Force in the 1960s and 1970s by helping to create effective training programs for a new generation of top-gun pilots and set the standard of flying excellence for Iran's air fleet. [Pakistan Defense Forum]

2-1-7 Post-revolution years and the era of multiple airlines

Following the revolution of 1979 in Iran, the country's airline industry entered an entirely new phase. Although then operating the largest number of airliners in its 17 year history, it was unable to exploit its strong position.

The Western embargo that followed the revolution in Iran changed the country's general policy for aviation from having the best available in the world to being able to

2.16 Abbas Atrvash (1937-2009), born in Abadan, was one of the great dignitaries of commercial aviation in Iran and the world, and one of the eminent managers of the Iranian National Airline (Homa). [Radio Zamaneh]

2.17 Akram Monfared Arya (b.1946) was born in Tehran. She and Princess Fatemeh Pahlavi (1928-1987) were the first Iranian women to be awarded a pilot's license. Currently living in Sweden, she is a poet, a pilot, a writer and a politician. [Personal website of Akram Monfared Arya]

2.18 Brigadier General Jalil Zandi (1951-2001), born in Garmsar, was the ace fighter pilot in the Islamic Republic of Iran's Air Force. He served for the full duration of the Iran-Iraq war. [Wikipedia]

manufacture indigenously to meet domestic needs, especially technological products, in order to become 'sanction proof'. Therefore Iran avoided the need to purchase the improved Western aircraft which became available to it from time to time, in favor of those that it could manufacture itself by purchasing licenses and technologies as well as reverse-engineering parts.[24] From the beginning of the 1980s until the end of the Iran-Iraq war in 1988, both internal and international travel reduced considerably owing to the war and the restrictions imposed on Iranians traveling abroad. However, after the ceasefire in 1988 the demand for air travel increased enormously. The two leading state-owned airlines, Iran Air and Aseman (earlier Pars Air) were apparently incapable of meeting this new demand. Consequently, some entrepreneurs and even government agencies showed interest in making up this shortage in capacity in order to gain a share of the lucrative air travel market. The government decided to abolish the airline's monopoly, relaxed the policy of awarding operating permits, and reduced the initial investment capital required for a startup airline. As a result, a large number of investors applied for permits to operate airlines. Domestic air travel was greatly expanded, more destinations were served, the frequency of flights

was increased, and more passengers were carried. On the other hand this hasty expansion led to chaos in the nation's air transport service, halting the entire industry's improvement. In the absence of adequate state laws, regulations, and policies to standardize and control airline operations, the quality of service declined, resulting not only in disarray and public dissatisfaction but also a number of incidents, disasters, and loss of life. The problems faced by the Iranian airline industry during this period were the direct result of adopting inappropriate strategies and either making incorrect decisions or failing to make a decision at the right time. One of the first mistakes was replacing highly qualified, experienced managers with inexperienced ones, many of whom were incapable of operating to professional standards. Then there was the sudden loss of a large number of irreplaceable personnel with specialist skills. The collective dismissal of highly qualified employees for contrived reasons that subsequently proved to be baseless was extremely destructive and irreversible.[25] Nevertheless there were still people in the Iranian airline industry whose efforts and services during the dangerous conditions of the 8 year war had kept aircraft flying, and were still managing to fly several million passengers each year.[26]

2.19 Hassan Shafti (b.1939), born in Isfahan, was a distinguished manager of the air transportation industry in Iran, founder of the Iranian Aerospace Society, and the first president of the Iranian Space Agency, serving from February 2004 to October 2005. [ISA]

2-1-8 Space Age and upgrading of aeronautics to aerospace

On December 17, 1903, the Wright brothers in the USA achieved the world's first 'heavier than air' flight with their handmade airplane. On October 4, 1957, the Space Age was initiated by the USSR launching the first artificial satellite. Iran, which was heavily committed to aviation, welcomed the start of the Space Age and in 1958 joined with 17 other countries to establish the United Nations ad-hoc Committee for International Cooperation on Space in order to use space technology for peaceful applications in the interests of economic and social development. The aims of this organization, later renamed the Committee on the Peaceful Uses of Outer Space (COPUOS), were to review international collaborative programs to exploit and use space technology for civilian purposes, serve as a forum for information exchange, and encourage the development of national programs to study outer space.[27]

In 1969, by establishing the Asad-Abad Ground Station in Hamadan and installing a 30m-diameter standard-A antenna to connect with the Intelsat international communications network stationed above the Pacific Ocean, Iran became a participant in the American telecommunications system. The Asad-Abad Telecommunications Center had been established a decade earlier by Mahmoud Hessabi (1903-1992),[28] a prominent Iranian scientist, researcher, and distinguished university professor. A polymath whose interests included

2.20 Mahmoud Hessabi (1903-1992), born in Tafresh, was a prominent Iranian polymath whose interests included space science and technology. He founded the Asad-Abad Telecommunications Center, the Iranian satellite tracking observatory in Shiraz, and the Geophysical Institute of the University of Tehran. He was also the Iranian delegated to the Scientific and Technical Subcommittee of UN-COPUOS from 1962-1968. [Professor Hessabi Foundation]

space physics, he developed space technology in Iran. Holding the title of 'father of modern physics in Iran', his achievements include setting up the first modern observatory of Iran in 1945 and establishing the satellite tracking center of Iran in 1957, both of which are in Shiraz, and founding and managing the Geophysical Institute of the University of Tehran (1951-1965).[29] He was also the Iranian representative on the Scientific and Technical Subcommittee of UN-COPUOS from 1962 to 1968.[30,31] Furthermore, he initiated the membership of Iran in the Committee on Space Research (COSPAR) and represented Iran in the UNISPACE-82 (United Nations Second International Conference on the Exploration and Peaceful Uses of Outer Space in 1982).[32] In 1972, after launching the Earth Resource Technology Satellite (ERTS), later renamed Landsat-1, the USA agreed to provide the technical assistance required to enable Iran to construct the Mahdasht Satellite Receiving Station (MSRS), which was at that time one of only five satellite data receiving stations around the globe, as Iran's first bilateral cooperation in space remote sensing technology.

Iran readily adopted the most common uses of space technology: telecommunications, television broadcasting, Earth remote sensing, navigation, tele-education, weather forecasting, environmental modeling, and relief and rescue operations. In 1974 Iran and the General Electric (GE) Company in the US entered into an agreement for the installation and operation of a satellite data receiving station. But with the onset of revolutionary upheaval in Iran in 1978, the company canceled its commitment to provide technical assistance for the installation and operation of the facilities for tracking the Earth resource satellites and the reception of their data. The initial Iranian efforts to establish independent space projects began in 1977, when the country decided to develop its own communications satellite system called Zohreh. However, despite the participation of a number of national organizations in the development of plans to operate research satellites in space, Iran was unable to pursue these projects entirely indigenously and required foreign assistance in certain fields of technology. Facing Western refusal to supply these technologies, Iran turned to the leading non-Western spacefaring countries of the USSR, China and India. North Korea and later Italy were Iran's other partners in space research and development. Along with the plan to develop its own first communications satellite system, Iran aimed to set up an Iranian Space Agency but the unstable revolutionary conditions and the protracted war with Iraq forestalled efforts to institutionalize space activities in Iran. What remained were some activities relating to space applications such as communications and remote sensing.

2-2 POLICY MAKING AND DEVELOPMENT

In Iran, the decision-making sources in the aeronautics industry are fixed. The policy-making and coordinating entity that promotes an indigenous Iranian aeronautical industry is currently the Iran Aviation Industries Organization (IAIO). It was established in 1966 with a mandate to plan, control, and manage the Iranian aviation industry. It also provides and assists with the required technologies, parts and knowledge. IAIO has five complementary aviation organizations under its umbrella: SAHA (Iranian Aircraft Industries-IACI), HESA (Iran Aircraft Manufacturing Industries Corporation-IAMI), PANHA (Iran

Helicopter Support and Renewal Company-IHSRC), the Ghods Research Center, and Shahid Basir Industry.[33]

Nevertheless, the structure and role of policy-making bodies for the development of aerospace in recent decades were altered as a result of expanding the domain of aerospace in Iran from aeronautics to astronautics. Those policy-makers are the Ministry of Post, Telegraph and Telephone (MPTT) that became the Ministry of Communications and Information Technology (MCIT) in 2003, the Islamic Republic of Iran Broadcasting Organization (IRIB), and the Ministry of Science, Research, and Technology (MSRT) that cooperated for telecommunications and broadcasting purposes, as well as various other applications.

Other national entities participating in policy-making for space-related issues are the Ministry of Defense and Armed Forces Logistics (MODAFL), the Ministry of Foreign Affairs, the Ministry of Industries and Mines (which merged with the Ministry of Trade in 2011 to form the new Ministry of Industry, Mines and Trade), and the Ministry of Roads and Transportation (which merged with the Ministry of Housing and Urban Development in 2011 to become the Ministry of Roads and Urban Development). The entities within MCIT involved with the application of space technologies include the Communications Regulatory Authority (CRA), the Telecommunication Company of Iran (TCI), the Telecommunications Research Center (TRC), and the Iranian Space Agency (ISA).

Although it has not yet been approved legally, since September 2010 ISA has been annexed by the Presidential Institution of the state. Established in 2003, CRA is a supervisory foundation intended to provide the basis for competitive marketing of telecommunications and incremental promotion and optimization of the quality of services that rely on space technology.[34] MODAFL is one of the major users of aerospace technologies in terms of defense and security issues at national level and beyond. Consequently, it has been traditionally one of the main policy-makers on aerospace issues since Iran became involved in these technologies. Indeed, in some cases MODAFL initiated the development, import and growth of a variety of technologies. The Aerospace Industries Organization, the Aviation Industries Organization, the Iran Electronics Industries Organization, and the National Geographical Organization are involved in the use of space applications.

There are important entities in the Ministry of Roads and Urban Development which, along with applying aerospace technologies, play a considerable role in policy-making. The Roads, Housing and Urban Development Research Center (RHUDRC), the Ports and Maritime Organization (PMO), the IR Iran Meteorological Organization (IRIMO), the Airline of the Islamic Republic of Iran (Iran Air), and the Technical Laboratory of Soil Mechanics (TLSM) affiliated with the Ministry of Roads and Urban Development are all involved in the use of aerospace technologies. The Ministry of Industry, Mines and Trade is also in charge of policy-making in the domains of industry, mines and trade, and hence plays a critical role in the policies and strategies related to the aerospace industry.

Other ministries and organizations involved in space technology applications are governed by the policies and strategies established for aerospace. These include the Ministry of Jihad of Agriculture, the Ministry of Interior and the Iran Department of Environment that is active under the Presidential Institution of the state. The Forests, Rangelands and Watershed Management Organization (FRWO) affiliated to the Ministry of Jihad of Agriculture determines the functions, including conservation of renewable natural

resources by combating and preventing illicit trafficking of forestry products that contravene the development and management of those resources. One of the important ways in which FRWO uses space technology is to monitor and mitigate undesirable degradation of natural resources owing to floods, overcharging dam reservoirs, soil erosion, landslides, desertification, environmental degradation and climate change, extinction of wildlife, reduction of livestock products, outbreak of pests and diseases, and extinction of forest and range species.[35] In the Ministry of Interior, the main user of space technology is the National Disaster Management Organization (NDMO) and its branches in the major cities, such as the Tehran Disaster Mitigation and Management Organization (TDMMO). NDMO is active in the forecasting and prevention of disasters, disaster response and preparedness, and reconstruction and rehabilitation. These tasks involve remote sensing, geographic information system (GIS), global positioning system (GPS), communications and so on.[36,37]

But the full institutionalization of these efforts was not achieved until February 2004, when ISA began operating according to Article 9 of the Law for Tasks and Authorizations of the Ministry of Communications and Information Technology (MCIT) that was passed by the Iranian parliament on December 10, 2003. The president of ISA simultaneously held the posts of Vice Minister for MCIT and the secretariat of the Space Supreme Council (SSC). ISA's mission was to monitor and support activities involving the peaceful application of space science and technology under the leadership of the SSC, which was chaired by the President of Iran. The creation of ISA was a major practical step towards advancing relevant science and technology in the effective use of outer space for peaceful purposes. The agency also played an important role in promoting international cooperation in these fields. Some of the key tasks assigned to ISA by the SSC were to undertake studies, research, and design and engineering in space services, to undertake remote sensing, to strengthen domestic and international space networks, to prepare medium- and long-term plans for space exploration, and to conduct studies and research in the design, construction and launching of satellites.

But then to increase the managerial efficiency of the space administration, the state decided on a number of organizational changes, including dissolving the SSC and then approving a new statute for the space agency. These changes occurred in 2007 and 2008 and resulted in the establishment of the Science, Research and Technology Commission that operates within the Cabinet of the President of the state of Iran. Under this new organizational structure, ISA was mandated to operate under MCIT and report to its Minister.

In a political dispute after the SSC was terminated, the Iranian parliament judged its dissolution to be unlawful and sent the matter to the supreme authority, the Expediency Council, which revived the SSC on September 27, 2008. Accordingly, the Executive branch of the government was mandated to revive the SSC just 8 months after its dissolution. Finally, the Iranian Vice President for Science and Technology established nine agencies to integrate the development of science and technology in their respective administrative fields. The administration of aerospace technology development commenced work in 2009. Although the SSC was revived in September 2008, according to the revised ISA statute the agency is not legally mandated to work under its auspices. Annexation of ISA to the Presidential Institution in 2010 has also caused more ambiguity, and in practice there is no legitimate statute for ISA to rely on in undertaking the basic and substantial functions and duties for which it was created.

Table 2.1. The civil organizations and bodies in Iran that play a role in space policy-making, research, development, and applications. [Author].

Entity/Organization	*Policy Making*	*Research*	*Development*	*Applications*
Supreme Space Council (SSC)	*			
Ministry of Communications and Information Technology (Ministry of CIT)	*		*	*
Iranian Space Agency (ISA)	*	*	*	*
Ministry of Science, Research and Technology (Ministry of SRT)	*	*	*	*
Ministry of Defense and Armed Forces Logistics	*	*	*	*
Ministry of Foreign Affairs	*	*		
Ministry of Industry, Mines and Trade	*		*	*
Ministry of Roads and Urban Development	*		*	*
Islamic Republic of Iran Broadcasting (IRIB)	*		*	*
Iranian Research Organization for Science and Technology (IROST)		*	*	
Space Research Center of Iran, ISA		*	*	*
Remote Sensing Administration of ISA		*	*	*
Alborz Space Center (ASC), ISA		*	*	*
Observatory of ISA, ASC		*		
Electrical and Computer Science Engineering Department (ECEDEP)		*	*	
Applied Science and Research Association (ASRA)		*	*	
Iran Telecommunication Research Center (ITRC)		*	*	*
Islamic Republic of Iran Meteorological Organization (IRIMO)			*	*
Iranian National Center for Oceanography (INCO)			*	*
National Committee on Natural Disaster Reduction (NCNDR)				*
Geological Survey of Iran (GSI)			*	*
Soil Conservation and Watershed Management Research Center (SCWMRI)				*
Research Institute for Astronomy and Astrophysics of Maragheh (RIAAM)		*		*
International Center for Science and High Technology and Environmental Science (ICSHTES)		*		*
Research Institute Applied Physics and Astronomy (RIAPA)		*		*
Institute of Geophysics (Solar Physics and Astronomy Section)				*

2-2-1 Policy-making organizations and entities related to development and applications

Some organizations and entities play important roles in the development of aerospace applications, and their contributions are discussed below.

Supreme Space Council (SSC)
Article 9 of the Law for Tasks and Authorizations of the Ministry of Communications and Information Technology established the Iranian Space Agency in February 2004 as an autonomous organization mandated to implement those strategies authorized by the Space Supreme Council (SSC), which was legitimized following the endorsement of this law.[38] Based on its approved statute, ISA was mandated to cover and support all the activities in Iran relating to the peaceful applications of space science and technology under the leadership of the SSC, as chaired by the President of the state, who was at that time Muhammad Khatami.[39] The SSC met for the first time on July 20, 2005. Its main goals included: policy-making for the application of space technologies; manufacturing; launching and the use of national research satellites; approving space-related state and private sector programs; promoting partnerships in private and cooperative sectors for the efficient use of space; and identifying guidelines for regional and international cooperation in space activities. But the SSC was dissolved in August 2007 and since its reestablishment in September 2008 it has not been legitimized by parliament. ISA was responsible to the secretariat of the SSC in Tehran during the period of its legitimate activity.

Ministry of Communications and Information Technology (MCIT)
The Ministry of Communications and Information Technology was the Ministry of Post, Telegraph and Telephone until 2003, when it was renamed. It is responsible for exercising frequency-spectrum management and protecting the national radio rights at both the regional and international levels; centralizing policy-making; writing regulations and standards and supervising their implementation in different areas of post, communications and telecommunications such as common and new services in post, telecommunications, space communications, radio communications, data transmission, sound and picture transmission, remote sensing and computer communications; developing a conducive environment for communications, testing, information processing and remote sensing methods, and supporting them; and also making policy for the development of the appropriate communications facilities and services, in line with the state-of-the-art in scientific, experimental and information technology.

Iranian Space Agency (ISA)
In addition to its policy-making role, ISA is the only national (governmental) space agency of Iran mandated to promote and participate in the civilian and peaceful applications of space science and technology. Practically, ISA is involved in conducting engineering and research in the fields of aerospace such as satellite development, communications and remote sensing. It was created in February 2004 by the Ministry of Communications and Information Technology to operate under the supervision of the Supreme Space Council chaired by the President of Iran, as specified in a 2005 statute. However, in 2007 the SSC was dissolved, and in 2008 a new statute was passed in which the ISA president was legally the deputy minister at MCIT. Prior to the approval of the 2008 statute, ISA was

responsible for implementing the space policy set by the SSC based on the 2005 statute. Then on September 29, 2010, ISA was annexed to the Presidential Institution by the Iranian Administrational Supreme Council. The agency is presently responsible for the execution of the space policy throughout the country. While its headquarters are located in Tehran, its subordinates are spread around the capital and other cities such as Karaj, Tabriz, Shiraz, Isfahan, Semnan, Chabahar, Gheshm and Mashhad.

Ministry of Science, Research and Technology (MSRT)
MSRT is responsible for higher education, research, and technology promotion in Iran. It conducts its activities mainly through deputyships for education, planning and development, technology, student affairs, research, culture and social issues, and legal affairs. Other bodies active in the realm of MSRT include the Supreme Council of Cultural Revolution, the Research Institute for Education Planning, the Iranian Research Organization for Science and Technology (IROST), the National Organization for Educational Testing, the Student Welfare Fund, the Central Board for the Selection of Educators, Students and Officials, Universities, Science and Technology Parks, and the Institutes of Higher Education and Technology.

Iranian Research Organization for Science and Technology (IROST)
The Iranian Research Organization for Science and Technology was approved and ratified by the Revolutionary Council of the Islamic Republic of Iran and established in 1980. Located in Tehran, it is a comprehensive science policy research center directly attached to the Ministry of Science, Research and Technology. It is engaged in the development of strategies, policies, research and development systems, management, foresight and evaluation of related science and technology development and economic progress. Its main goal is to support the development of technology through research and development at the national level. To achieve this goal, IROST offers scientific, technical, financial, legal, administrative, and cultural support to applicants. It creates conditions conducive to efficient, effective interaction between the demand for, and supply of technology. It thereby provides fertile grounds for creativity and innovation in applying the results of research, and commercializing in a competitive environment the technologies derived from research and development. One of the six institutes of the organization is the Aerospace Mechanics Group of the Mechanics Institute. This is responsible for important projects such as the design and construction of the Mesbah satellite.[40]

Electrical and Computer Science Engineering Department (ECEDEP)
The Electrical and Computer Science Engineering Department was established in 1980 as an IROST subdivision to support researchers and talented people. Its objectives include the accomplishment of research, applicable semi-industrial projects, compiling technical knowledge and transferring this to industry. Based in Tehran, it has a Space Technology Group that works on satellite payloads, ground stations, and space applications. A number of technology laboratories are associated with the Space Technology Center of ECEDEP, including the Satellite Signal Processing and Data Center, the Space Battery Laboratory, the Space Simulator, the Solar Cell Test Bed, the Space Quality Assurance, the Telemetry and Telecommand (TMTC) Laboratory, the Space Software Test-bed, the Telemedicine Laboratory, the Space Sensor, Monitoring and Control Laboratory, the Electromagnetic

Compatibility (EMC) Laboratory and the Electrical Ground Support Equipment (EGSE) Laboratory.

Islamic Republic of Iran Broadcasting Organization (IRIB)
Based in Tehran, the Islamic Republic of Iran Broadcasting Organization is a state-run enterprise belonging to the so-called cultural institutions, and as such is subordinated to the Secretariat of the Supreme Council of Cultural Revolution.

Applied Science and Research Association (ASRA)
ASRA is subordinated to the Department of Mechanical Engineering at the Khajeh Nasir-e Tusi University of Technology in Tehran, and functions as the Iranian member of the Inter-Islamic Network on Space Sciences and Technology (ISNET).

Iran Telecommunications Research Center (ITRC)
This is affiliated to the Ministry of Communications and Information Technology. It is a well-known research entity in the fields of information and communication technology. Based in Tehran, it runs advanced research facilities and laboratories that enable research teams to conduct studies and carry out experiments.

Islamic Republic of Iran Meteorological Organization (IRIMO)
With its headquarters in Tehran and branches in almost all provincial centers, IRIMO is responsible for all meteorological information and weather forecasting in Iran. It uses data from meteorological satellites not only for weather forecasting but also for atmospheric disaster mitigation objectives.

Iranian National Institute for Oceanography (INIO)
Located in Tehran, this center operates under the auspices of the Ministry of Science, Research and Technology and carries out research in all fields involving marine science. It proposes better use of marine resources, promotes commercial utilization of marine activities, formulates marine strategies within the framework of government activities, and improves the level of knowledge, research and marine technology.

National Committee on Natural Disaster Reduction (NCNDR)
The responsibilities and functions related to disaster management at the national level in Iran were assigned to the Ministry of Interior (MOI) in 1991. To manage these functions, MOI established the National Disaster Task Force (NDTF) and the Bureau for Research and Coordination of Safety and Reconstruction Affairs (BRCSR). The NDTF is a coordinating inter-organizational entity that varies its activities during the sequential phases of a disaster. It is headquartered at the MOI in Tehran and relies for its activities upon BRCSR, whose director is also the manager of the NDTF. Around 4,550 staff work at national, provincial and local levels, mostly dealing with administrative and logistical support services. As part of the International Decade For Natural Disaster Reduction (IDNDR), the Islamic Consultative Assembly approved the establishment of the National Committee for Natural Disaster Reduction (NCNDR) in 1991 headed by the Ministers of Energy, the Ministry of Jihad of Agriculture, the Ministry of Health and Medical Education, the Ministry of Industry, Mines and Trade, and the Ministry of Roads and Urban Development. Its membership also includes the directors of the Iran Department of Environment, the IR Iran Meteorological Organization, the Forests, Rangelands and Watershed Management

Organization (FRWO), the Institute of Geophysics of Tehran University, and the Iranian Red Crescent Society. Any other organizations that the chair of the committee deems necessary are also allowed to participate. The National Committee was designed as a policy-making body to facilitate the exchange of information and provide a mechanism to enable the government to authorize, support and pursue related activities. It has set up a coordination committee presided over by the Minister of Interior and nine specialized subcommittees presided over by deputy ministers and 30 provincial committees presided over by general governors.

Geological Survey of Iran (GSI)

The Geological Survey of Iran was established in 1962 by a special fund of the United Nations. The GSI is authorized to carry out geological and mineral investigations throughout the country, to collect the results of such activities, to establish an interrelationship and coordination between them, and to produce geological maps of Iran. In 1999 the exploration duties of the Ministry of Mines and Metals were transferred to the GSI. It is responsible for geologically surveying the country and assessing all mineral resources except hydrocarbons. These activities are undertaken by GSI groups which include Stratigraphy, Petrology, Sedimentology, Marine Geology, Paleontology, Tectonics, Seismotectonics, Exploration, Geophysics, Geochemistry, Geomatics, and other laboratories according to the general directions laid down by the former Ministry of Mines and Metals and current Ministry of Industry, Mines and Trade in accordance with the approved Mining Law. The headquarters are in Tehran, and there are five branches in the northwest (Tabriz), northeast (Mashhad), south (Shiraz), southwest (Ahwaz) and southeast (Kerman) of the country to undertake local functions. It has a staff of 700 highly skilled people. The GSI also cooperates with other organizations in Iran and abroad through bilateral cooperation or joint research programs. Since the autumn of 1992, GSI has published the *Geosciences Scientific Quarterly Journal* as a vehicle for transferring geological knowledge and promoting new scientific findings.

The General Office of the Space Services and Remote Sensing of ISA

The General Office of the Space Services and Remote Sensing of the Iranian Space Agency currently performs the official tasks of the former Iranian Remote Sensing Center (IRSC). There is an office for remote sensing located at ISA headquarters in Tehran, but the agency's remote sensing facilities are at the Alborz Space Center (ASC), which consists of the Mahdasht Satellite Receiving Station (MSRS), an observatory, and various communication systems and satellite ground systems. The National Data Archive and the Remote Sensing National Laboratory are being developed at ASC. In addition, for around a decade in the 1970s and 1980s, MSRS hosted the headquarters of the Iranian Remote Sensing Center.

Alborz Space Center (ASC)

The Mahdasht Satellite Receiving Station (MSRS) was created in 1972 under a bilateral agreement between the USA and Iran. The current Alborz Space Center, which is affiliated with ISA, was built on the former site of the Mahdasht Satellite Receiving Station in the vicinity of Karaj approximately 65km west of Tehran, which was set up to receive data from the Landsat satellite. The site is being developed to accommodate the most comprehensive and multi-function ground space complexes, as well as work, living and leisure

facilities for space science and technology specialists, scientists and officials. The main elements of the General Office of Space Services and Remote Sensing, the part of ISA which carries out the tasks of the former Iranian Remote Sensing Center, are located at ASC. In addition to the receiving stations for data acquisition from the US National Oceanic and Atmospheric Administration (NOAA), the US Terra, and the Chinese FY2-C, -E and -D satellites, new installations have been added in recent years, in particular an optical observatory, reference tracking and control ground installations for the Navid microsatellite that was developed by the Iran University of Science and Technology (IUST), and the facilities for monitoring the frequency spectrum of Iransat (Badr 5; Arabsat). There are also plans to include the National Data Archive and the Spectral Laboratory of the Remote Sensing National Laboratory.

Soil Conservation and Watershed Management Research Institute (SCWMRI)
The Soil Conservation and Watershed Management Research Institute of the Agricultural Research and Education Organization (AREO) is the focal point for soil conservation, watershed management, flood management and exploitation, river engineering and training, coastal protection, hydrology and water resources development in the Ministry of Jihad of Agriculture in Iran. It is located on a campus in Tehran and focuses on research topics in the aforementioned topics.

2-2-2 Industries and companies involved with aerospace development and production

Apart from basic skills and technologies, the development and production of satellites and launch vehicles requires the availability of high-technology industries. In Iran a considerable number of organizations are involved in technology development, production and research for the aerospace field. The following industries support the Iranian space endeavor.

Iran Aviation Industries Organization (IAIO)
The Iran Aviation Industries Organization, known as the Sazeman-e Sanaye-e Havai-e Iran, is the pivotal entity for aeronautics in Iran in terms of both policy-making and technology development. Located in Tehran, it was established in 1966. Under the IAIO, the Iran Helicopter Support and Renewal Company (IHSRC), known by its abbreviation in the Persian language as PANHA, was established in 1969. The Iran Aircraft Industries (IACI), known as SAHA, was established in 1970. The Iran Aircraft Manufacturing Industries Corporation (IAMI), known as HESA, was founded in 1976. Two other important companies, the Ghods Research Center and the Iranian Armed Forces Aviation Industries Organization (IAFAIO), which is also known as Shahid Basir Industry, were established in the 1980s. As an agency of the Ministry of Defense and Armed Forces Logistics (MODAFL), the IAIO and its many subsidiary companies are involved in building jet engines, parts for a variety of aircraft, repair and maintenance, overhauling passenger planes, and the construction of hangars for wide-body aircraft. It is judged the largest company of its type in the Middle East.[41] By September 2004, Iranian Aviation Industries had produced more than 1,600 aircraft, 2,182 aero-engines, 1,751 helicopter engines, 149 industrial jet engines, and was repairing more than 11 models of aircraft and 18 models of military, commercial and industrial aircraft engines. Furthermore, Iran was mass

2.21 The indigenously designed and manufactured Azarakhsh fighter jet. [ISNA]

producing the indigenously designed Azarakhsh and Saegheh fighter jets and had plans to expand its production to helicopters, turboprops and passenger planes.[42] The country's Boeing 737-800 simulator is the first in the Middle East. Iran currently possesses only nine aircraft for every million citizens but the objective is to make 6,300 airplanes available to the Iranian population of 70 million.[43] The Research Institute of IAIO is involved in the design of piloted and pilotless aircraft, the simulation of aerodynamic processes in computational fluid dynamics laboratories, the provision of aerodynamics tests, the development of aviation products using the national wind tunnel, the design of systems for launching and retrieving aircraft, the standardization and validation of avionic products for training purposes, the promotion and development of laboratories appropriate to the aviation industry, and the evaluation, control and auditing of aviation projects.[44]

Iran Helicopter Support and Renewal Company (IHSRC)

Based in Tehran, the Iran Helicopter Support and Renewal Company, or Sherkat-e Poshtibani va Nowsazi-e Helicopter-e Iran in the Persian language, known as PANHA, is the largest of its kind in the Middle East. In the military aviation sector the company maintains and repairs helicopters such as the Bell 205, 206, 209, 212, 214 and 412, and the CH-7, RH-53D, SH-3 and MIL-171 in accordance with military standards. In the civilian field, this is the only firm that has received a license from the National Aircraft Organization for maintenance efficiency. This company also produces helicopters, black boxes, floating systems, and many other aircraft parts.[45]

Iran Aircraft Industries (IACI)

Iran Aircraft Industries or Sanaye-e Havapeymai-e Iran, known as SAHA, was established in 1970 in Tehran mainly for the repair of fighter, passenger, and air support aircraft. Over time, SAHA became an important part of the nation's aviation industry. In 1998, IACI started designing, engineering, and manufacturing complex engine parts and airplane

2.22 The manufacturing line for the IrAn-140, the Iranian HESA Maritime Patrol Aircraft in the Iran Aircraft Manufacturing Industries Corporation (IAMI). [Fars News Agency]

parts, as well as manufacturing turbine engines like the Tolou-4. Its most recent activities include working on the TV-3 turboprop engines for the IrAn-140 aircraft. The company mass produces the Tolou-4 mini jet engine, and is capable of repairing aircraft such as the Boeing 747. It is also experienced in repairing Dart engines, and building the repair lines for heavy engines such as the Astazo, F, and Solar.[46]

Iran Aircraft Manufacturing Industries Corporation (IAMI)

The Iran Aircraft Manufacturing Industries Corporation or Karkhanejate Sanaye-e Havapeymai-e Iran, also known as Hava-peyma Sazi-e Iran, HESA was established in 1976. The corporation is located in Shahin-shahr of Isfahan but has its head office in Tehran. It was the first aircraft manufacturer in Iran. By technology transfer from the Ukraine, this company manufactures IrAn-140, a 52-seat passenger airplane with a jet propeller engine and a flight range of 2,000km. It also designs and manufactures a variety of drones, fuselages, and other aircraft.[47] IAMI is a large industrial complex affiliated with the Ministry of Defense and Armed Forces Logistics (MODAFL). It is a major defense contractor for the Guardian Corps of the Islamic Revolution and its projects, including development of the Ababil unmanned aerial vehicle (UAV).[48–50]

Iranian Armed Forces Aviation Industries Organization (IAFAIO)

The Iranian Armed Forces Aviation Industries Organization, Sazeman-e Sanaye-e Havai-e Niroohaye Mosallah-e Iran, more famous as Shahid Basir Industry, was created in 1987 in Tehran as an aviation manufacturing company. Presently, it is the main center for the production of over 5,000 military and non-military parts and accessories. To produce more and better parts, it exchanges information with universities, research centers, and private companies around the country. It also provides services to the nation's ground and air forces.[51]

Ghods Research Center
Located near Tehran, the Ghods Research Center, also known as Ghods Aviation Industries, is an Iranian aviation manufacturing company created in 1985. It makes pilotless aircraft, including the Ababil, Saegheh, Talash and Mohajer, as well as powered paragliders and other products. It has also developed a variety of parachutes, including free-fall personal parachutes, Strato Cloud parachutes, Ofogh parachutes, and Fakhteh parachutes. Its many services include the design and manufacture of ground control station electronics, imagery, targeting, and optical tracking and aviation systems.[52,53]

Aerospace Industries Organization (AIO) of Iran
The Aerospace Industries Organization of Iran, Sazemane Sanaye-e Hava-Faza, known as SSH, is located in Tehran. It is a leading high-tech industry and military subsidiary of the Sanam Industrial Group, which is Department 140 of the Defense Industries Organization of the Ministry of Defense and Armed Forces Logistics (MODAFL). Its products include the Shahab ballistic missile, launchers, rocket and booster propellants and components. It also supplies non-military items and services such as fuel pumps, technical and engineering services, and research and development. AIO is the obvious organization to lead the development and production of the space assets of Iran. It manages a number of factories and research centers, including the Missile Center of Saltanat-Abad, the Vanak Missile Center, the Parchin Missile Industries factories, the Bagheri base factories 1-3, the Tabriz Bakeri base factory, the Bakeri Missile Industries factory, the Hemmat Missile Industries factory, the Bagh Shian (Almehdi) Missile Industries, the Shah-Abadi Industrial Complex, the Khojir Complex, the Bagherol-Olum Missile Research Center, the Mostafa Khomeini base factory, and the Ghadiri Base factory.[54]

Shahid Hemmat Industrial Group (SHIG)
Based in Tehran, the Shahid Hemmat Industrial Group is subordinated to the Aerospace Industries Organization and has several divisions that are involved in the manufacture and operation of launch vehicles, such as Kalhor Industry (launchers), Karimi Industry (spares that transfer propellants to the engine and other parts of the launch vehicle), Cheraghi Industry (production of propellants), Rastegar Industry (launch vehicle engine production), Varamini Industry (launch vehicle guidance and control systems), and Movahed Industry (manufacturing and assembly of launch vehicles).[55]

Iran Electronics Industries (IEI)
Known as the Sanaye Electronic-e Iran (SEI) in the Persian language and more famously as SAIran, Iran Electronics Industries was established in 1973. It is presently the country's leading producer of electronic systems and related products. Its main office is located in Tehran. It has eight subsidiaries and around 5,200 experienced staff who are involved in manufacturing over 100 different electronic products. IEI is the largest electronics corporation in Iran, and about 65% of its personnel are highly trained engineers in various disciplines. In the aerospace domain, it designs, develops, manufactures, tests and uses various types of research, remote sensing, and communications satellites in addition to various ground stations, including image receiving, telemetry, tracking and command (TT&C), flight control center (FCC) and user terminals (UT). SAIran designed and

developed the first indigenously produced satellite of Iran, named Omid, which was launched in February 2009. Its military products include telecommunications, electronic warfare, radars, optics, electro-optics and lasers, security and encryption, and command, control, communications, computers and intelligence (C4I). It also makes modern tactical communications systems in the HF, VHF and UHF ranges, and field telephones and switchboards. Moreover, it designs, produces and develops a wide range of security systems in the field of Security of Communications and Information Technology. In optics and electro-optics, IEI makes thermal imagers, night vision systems, laser range finders, and the optics for daylight sights.[56] Its subsidiaries include Shiraz Electronics Industries (electronic technology), Iran Communication Industries (communications technologies), Information Systems of Iran (information technologies), Electronic Components Industries (microelectronics), Isfahan Optics Industries (optics), Security of Telecommunications and Information Technology (communications security), the Iran Electronics Research Center (research and development) and the Iran Space Industries Group (manufacturing of satellites).[57]

Iran Space Industries Group (ISIG)
Located in Tehran, the founding of the Iran Space Industries Group as a subordinated entity to IEI was announced on the occasion of the launch on February 4, 2008 of the Kavoshgar-1 rocket.[58]

Shiraz Electronics Industries (SEI)
Shiraz Electronics Industries is a firm that has been professionally engaged in electronic products and projects since 1973. Combining highly skilled personnel with advanced equipment and an abundance of motivation has produced a powerful technological industrial group focused on electronic warfare, control and automation, radar and microwaves, weapon electronics, avionics, computers and electro-optics applications.[59]

Iran Communication Industries (ICI)
Iran Communication Industries, known as Sanaye-e Mokhaberat-e Iran in the Persian language, is the country's leading manufacturer of military and civil communication equipment and systems. Based in Tehran, it has more than 75 products in the field of tactical communications and encryption systems to meet a wide range of military requirements.[60]

Information Systems of Iran (ISIRAN)
Information Systems of Iran located in Tehran is a state-owned company founded in 1971. It is one of the largest and most experienced information companies in the country, and is reportedly the leading information technology company in terms of revenue, market share, and the variety and quality of its products and services. It assists and provides its clients with state-of-the-art information systems.[61]

Electronic Components Industries (ECI)
Electronic Components Industries was founded in 1976 and has two facilities, one in Shiraz and the other in Tehran. Its activities include the design and manufacturing of semiconductor devices, quartz crystal, multilayer printed circuit boards, and thick film hybrid, infantry field wire, optical cable and access systems.[62]

Isfahan Optics Industries (IOI)
Isfahan Optics Industries was founded in 1987 to create a vigorous and modern optics industry. The employment of highly qualified engineers and state-of-the art equipment has made it one of the most capable industries in Iran. It has designed and manufactured complex lenses and prisms, multilayer coatings, a wide range of daylight sights, and various types of aircraft windshields.[63]

Iran Electronics Research Center (IERC)
The Iran Electronics Research Center was founded in 1997 as a scientific, educational and research institute. It has research teams active in the fields of electronics, communications, microprocessors, microelectronics, optics, electro-optics and radars. It is capable of handling the multiple technology range of large products.[64]

Shahid Bagheri Industrial Group (SBIG)
The Shahid Bagheri Industrial Group, also known as the Iran Technical Organization (IRTO), is part of the Defense Industries Organization (DIO) based in Tehran. It reportedly cooperated with Russia's Baltic State Technical University and the Sanam Industries Group to create the Persepolis (Takht-e Jamshid) joint missile education center in Iran which transfers missile technology from the Russian Federation to Iran.[65]

Iran Telecommunication Manufacturing Company (ITMC)
Iran Telecommunication Manufacturing Company was created in 1967 to produce systems for high capacity telecommunications centers and on-the-table telephones. It operates factories in Tehran and Shiraz. The present stockholders are MCIT (45%), the Mine and Industry Bank of Iran (35%), and Siemens (20%). As the largest manufacturer of telephone high capacity centers in Iran, by the end of 2001 it had produced ten million fixed telephone lines and nearly 500,000 mobile telephone lines, covering 80% of the fixed and 20% of the mobile telephones in the country. In recent years, these factories received an ISO 9001 certification which resulted in $850,000 of exports to other countries. The principal capabilities of the company includes the design, production and installation of mobile telephone centers, and the design and production of fixed high capacity switches for local, mobile, urban and STD (standard) systems. The company has currently more than 1,000 employees.[66]

Telecommunication Company of Iran (TCI)
The Telecommunication Company of Iran is subordinate to the Ministry of Communications and Information Technology and has branches in almost every province. Its chief responsibility is the development and management of the country's communications infrastructure, particularly using satellite-based and ground-based telecommunications.[67]

Security of Telecommunications and Information Technology (STI)
The Tehran-based Security of Telecommunications and Information Technology (STI) is supervised by Iran Electronics Industries (IEI/SAIran).[68] It utilizes a wide variety of security systems designed and produced by IEI for Security of Communications and Information Technology.[69]

National Cartographic Center (NCC)
Established in 1953 in Tehran, the National Cartographic Center is the principal authority for the production of maps and spatial information under the IR Iran President's Deputy

for Planning and Strategic Supervision. Having 800 highly experienced personnel, NCC undertakes supervision and technical control of mapping and spatial information projects that are carried out by NCC itself, by other governmental organizations, and by private mapping companies. It has been responsible for creating the base map of the country and appropriate marine charts, the design and establishment of National Geodetic Control and geodynamical networks, the establishment of national, regional, and urban spatial topographic databases, and the production of small-scale base maps and national atlases. The expertise gained during the course of half a century enables NCC to undertake and supervise all manner of mapping and spatial information projects at the national and international levels.[70]

Research Institute of Space Science and Technology (RISST), Amir-Kabir University of Technology

The Research Institute of Space Science and Technology was created at the Amir-Kabir University of Technology (AUT) to meet Iran's needs in designing, manufacturing and applying space products and space-related projects as approved by the Council of Higher Education Development with the support of the Iranian Space Agency.

Shahid Rezaie Research Institute (SRRI), Sharif University of Technology

The Shahid Rezaie Research Institute was affiliated with the Sharif University of Technology (SUT) in 1999 to undertake research designed to enable the country to achieve technological self-sufficiency in a variety of fields, including aerospace, and facilitate the entry of an educated young workforce to the work environment.

Space Research Center (SRC) of Iran

With the annexation of the Iranian Space Agency to the Presidential Institution in 2010, the Aerospace Research Institute (ARI) and the Agricultural Engineering Research Institute (AERI), the latter more usually called the Engineering Research Institute (ERI), came under the umbrella of the space agency and, together with the Space Research Institute (SRI) of ISA, formed the Space Research Center. The Aerospace Research Institute of Iran was renamed the Astronautics Research Institute (ARI), but still follows its former functions when working under the Ministry of Science, Research and Technology. ARI was established in 2000 to conduct research into aerospace. It has pursued a range of activities in order to achieve the research needs of the country and to establish connections with related industries:

- Recognition and introduction of aerospace technologies, and cooperation with related entities and organizations in order to acquire the latest aerospace technologies.
- Development and expansion of research in the aerospace field in order to meet the research needs of the country.
- Cooperation with research and educational organizations of the country in order to improve the quality of related research activities.

Located in Tehran, ARI has expanded research facilities and established an environment that is conducive for research. Its facilities include a parallel processing laboratory, an electronics laboratory, a virtual reality laboratory and an Information Technology

Center. In addition it has construction and assembly plants and a library.[71] In line with the plan of the country to send astronauts into space by 2021, ARI has been conducting practical experiments on life in space by developing a space bio-capsule.[72] It was the principal contributor to the development of the capsule in which a monkey was launched by a Kavoshgar rocket to an altitude of 120km on January 29, 2013, marking the first time that Iran sent a primate into space.[73]

The Space Research Institute (SRI) of the Iranian Space Agency was established in Tehran under the authorization of the Council of Higher Education Development in 2007 with the goal of meeting the research needs of the nation's space technology industry. It is mainly in charge of developing the Masbah-2 satellite project.

2-2-3 Non-governmental organizations and private firms

The contribution and involvement of non-governmental organizations as well as the private sector in the development of aerospace activities, services and industries is significant. Moreover, NGOs are involved in policy-making in the nation's space endeavor. Because aerospace is a research-intensive industry that requires major capital outlays for research and development before production can start, only a small number of private technological firms operate in Iran. Their contribution is primarily in the aeronautical sector of aerospace. Activity in the astronautical sector requires greater investment, knowledge, and highly developed skills and expertise. Some of the active NGOs and private firms in the aerospace domain are given below.

Iran Aviation and Space Industries Association (IASIA)
The Iran Aviation and Space Industries Association is a non-governmental entity with 27 participating companies that are active in the aerospace industry. It was established in 2007 and has its secretariat in Tehran.

Iranian Aerospace Society (IAS)
The Iranian Aerospace Society is engaged in activities relating to scientific development, research, and specialized technical aspects of aerospace for peaceful purposes. It was established in 1993 and has its secretariat in Tehran.[74,75]

Andisheh Bartar Company (ABC)
The Andisheh Bartar Company is a private center pursuing industrial studies that relate to air traffic, particularly in ultra-light unmanned aircraft. The company is the first specialized center for recruiting, training on the construction and operation of model aircraft and the sale of spare parts. It is located in Isfahan.[76]

Aram Azmoon Company (AAC)
The Aram Azmoon Company Aviation Non-Destructive Testing (NDT) Services and Training Center was established in 1996 with the aim of providing aerospace engineering and consulting services and training. It is the only center approved by the Iranian Civil Aviation Organization to offer all the NDT services and training in aviation in accordance with common global standards. The company benefits from the high expertise of its inspectors in providing the services to its customers.[77]

Arya-Tech International Company (ATIC)
The Arya-Tech International Company is a private firm established in 2003. Based in Tehran, it was mainly founded with the aim of generating rapid prototypes in the industrial field. Over the course of the years, it has gained experience in 3D scanning, rapid modeling, replica building, rapid prototype molding, and piece building. It has excelled in aerospace, with its artisans and experts contributing to and expediting the evolution of research by constructing visual and conceptual models.[78,79]

Dorna Aerospace Company (DAC)
The Dorna Aerospace Company is a private joint-stock venture which specializes in designing and manufacturing lightweight aircraft covering EASA (European Aviation Safety Agency), CS-VLA (Certification Specification for Very Light Aircraft), ASTM LSA (American Society for Testing and Materials- Light Sport Aircraft), and FAR Part-23 (Federal Aviation Regulations Part-23) categories. Located in Tehran, it was established in 1988 by a group of aerospace engineers and technicians and has received the Design Organization Approval Certificate, Type Certificate and Production Approval Certificate qualifications for its two-seat aircraft called Blue Bird and the UL/LSA (Ultra-Light/Light Sport Aircraft) aircraft called Free Bird. Its main objectives include the design and manufacturing of lightweight aircraft in the JAR-VLA (Joint Aviation Regulations-Very Light Airplane) category and JAR23 by implementing projects using composite materials instead of metals.[80]

Energy Systems Planners Company (ESPC)
The Energy Systems Planners Company, known as the Tadbir-garan Industrial Research Center, is a private venture founded in 2005. Based in Tehran, it undertakes activities in the four fields of energy, computational mechanics, aerospace, and management. The company holds the accreditations of the Ministry of Science, Research and Technology and of the Ministry of Industry, Mines and Trade. In 2007 it was chosen as the Excellent Industrial Research Center by the then-Ministry of Industry and Mines. Its aerospace section carries out projects related to the analysis, design and manufacturing of aircraft and air/space systems, along with their associated subsystems.[81]

Raha Institute (RI)
The Raha Institute is one of the country's leading private aerospace entities. Located in Tehran, it was created in January 2004 to develop the aerospace industry in the private sector in Iran and its activities include aircraft manufacturing, airline and airport industries, air traffic control, and avionics systems. It also provides management consultation, engineering and technical services, and cultural activities. RI is also the main sponsor of avia.ir, the first Iranian Aerospace News Agency.[82]

3

Education, research and public awareness for capacity building

Outer space, or simply space, is the void that exists between celestial bodies, including the Earth and the entire universe. It is the physical universe beyond the Earth's atmosphere. The part of this region within the solar system is known as interplanetary space, the part beyond the solar system but within the Milky Way or within another galaxy is known as interstellar space, and the part between galaxies is known as intergalactic space.[83,84]

There is no definite boundary at which the atmosphere of our planet ends and outer space begins, but an altitude of 100km above sea level is conventionally used for the purpose of space treaties and aerospace record-keeping by the Fédération Aéronautique Internationale (FAI) because above that the remaining air is too thin to support aeronautical flight. This is known as the Kármán line. With no air to scatter sunlight and produce a blue sky, space appears as a black blanket dotted with stars. Although interplanetary space is commonly thought of as a hard vacuum, it actually contains a tenuous plasma, predominantly of hydrogen and helium, that streams from the Sun in the form of a 'solar wind' with the plasma carrying magnetic fields, as well as small dust particles, electromagnetic radiation which spans the entire spectrum, neutrinos, and high-energy cosmic rays. Interstellar and intergalactic space also contains dark matter and dark energy.[85,86]

Space exploration is the discovery and exploration of outer space by means of space technology. Physical exploration is performed both by robotic spacecraft and by human missions. Astronomy, as the science of observing celestial objects, began in ancient times but it was not until the development of large and relatively efficient rockets in the early 20th century that the physical exploration of space became possible. In addition to furthering scientific research, rationales for exploring space include enabling countries to develop military and strategic advantages against their rivals on the one hand, and on the other hand uniting nations around a mutually beneficial objective, and, in the longer term, working to ensure the survival of humanity.[87]

The physical exploration of space began during the 20th century with the advent of high-altitude balloons but it was the development of single- and multi-stage rocket launchers that enabled satellites to be placed into orbit and sent into interplanetary space. The first satellite was put into Earth orbit by the USSR on October 4, 1957. That country also sent the first man into orbit on April 12, 1961. Since then, unmanned spacecraft dispatched

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by a variety of nations have been sent to all of the major bodies in the Solar System and a number of the minor ones as measured in terms of their mass.

Outer space represents a challenging environment for humans owing to the dual hazards of vacuum and radiation. Weightlessness has a harmful effect on human physiology, resulting in muscle atrophy and bone loss. Human space exploration has so far been limited to low Earth orbit and the Moon. Our robotic vehicles are exploring the remainder of the Solar System. The space beyond the Solar System remains inaccessible except by passive observation with telescopes.[88] At home, using observation and monitoring apparatus and tools carried by satellites we can monitor synoptically and continuously the terrestrial environment, including its atmosphere and the state of the natural resources on land and in marine areas. This permits the forecasting, monitoring, control and mitigation of a variety of natural and man-made disasters. Most communications systems, television broadcasting, Internet connection, high capacity data transfer, and precise position determination are practically impossible without the benefit of space technologies. To this should be added the tele-education and tele-health services that are widely improving the quality of human welfare, as well as sustainable development on national, regional and global levels.

Developing space exploration and exploiting it for the benefit of life on Earth requires profound knowledge of nature, and of the universe of which our planet is a tiny part. It is essential to have an understanding of the four known fundamental forces of nature. In addition to the forces of gravity and electromagnetism that we observe in our daily lives, there is the so-called strong force that holds the nuclei of atoms together and also the weak force that causes radioactive decay. Without these forces, all matter in the universe would disintegrate into subatomic particles and float away.[89] Physics is the only science that addresses all four of these fundamental forces. But to fully understand the nature of the universe, it is necessary to know astronomy as well. Other disciplines like mechanics, electronics, material science, etc., are each useful in specific domains. So the process of educating people about space must start with physics and astronomy. The engineering and technical fields of aeronautics and astronautics are essentially the practical application of physics.

Education is a major component of capacity building in the Iranian space endeavor. Although it is widespread in the country, it must be developed further in order to put in place the infrastructures for the use of space technology. However, owing to the high cost of experimental tools and laboratories, the growth of space education and research in the nation's research institutes and physics departments is confined to theoretical studies and work that is facilitated by the virtual reality of cyberspace. The status of astronomical and astrophysical studies is more favorable, with a number of observatories at different sites around the country that use telescopes and other observational tools to support research and education about the universe, mainly in the optical spectrum but also in the microwave spectrum. Aerospace education in Iran is mainly focused on the engineering and technical aspects of exploiting space, namely the development of rockets and projectiles to reach outer space and the development of satellites to carry the apparatus and tools for Earth observation, communications and some monitoring and control systems. Iran is currently not involved in the more costly process of sending vehicles into deep space for purposes of exploration. However, human spaceflight is attractive. In the early 1990s, Iran and the Soviet Union made an agreement in principle to undertake joint Soviet-Iranian flights to

the Mir space station for exploration and research in space purposes. Unfortunately, such a flight was not possible.

Infrastructure and capacity building is essential in the development of aerospace technology by any country. In Iran, the education, training and capacity building was initially developed by relying upon the purchase of foreign systems and by sending young, talented Iranians for training in host countries so that their knowledge could be shared when they returned home. In later years, it became necessary to develop indigenous education and capacity building as a means of giving shape and orientation to Iran's space endeavor. A considerable number of highly educated Iranian individuals have influenced the growth of science and knowledge of space and its related technologies, both at home and around the world. There is no border for the scientific and technical services that an individual can carry out, but their influence at home is a blessing which should be appreciated and profited from by the people and their rulers.

Mahmoud Hessabi (1903-1992) was a prominent Iranian scientist, researcher, and distinguished professor at the University of Tehran. He was a polymath who studied different fields including space science and technology. During the congress on 'Sixty years of physics in Iran', the services rendered by him were deeply appreciated; indeed, he was awarded the title of 'The Father of Modern Physics in Iran'. In addition, he is renowned as the founder of the Science and Engineering facilities of the University of Tehran, for inventing, for bearing the Légion d'honneur, for 'Continuous particles' or 'Infinitely extended particles' theory, for being the Minister of Education in the nationalist cabinet of Dr. Muhammad Mosaddegh from 1951 to 1952, and for various other national contributions.[90] He received his primary and secondary education in French and American Schools in Beirut between 1910 and 1919, then gained a degree in road engineering in 1922 at the American University of Beirut as a preliminary to working for the Ministry of Roads in Beirut. In 1923 he moved to Paris and obtained a bachelor's degree in electrical engineering from the Ecole Supérieure d'Electricité in 1925. He later worked as an electrical engineer in the Paris railway system. In the meantime, he continued his studies in physics at Paris-Sorbonne University under the famous physicist Aimé Cotton, obtaining his doctorate in 1927.[91] He was the sole Iranian student of Professor Albert Einstein. During his years of scientific research he had discussions with well-known scientists such as Erwin Schrodinger, Max Born, Enrico Fermi, Paul Dirac, Niels Bohr, and scholars such as Bertrand Russell and Andre Gide.[92] He undertook research in Princeton and Chicago, and carried out many different experiments in order to verify his theories. He published his research in 1946 at Princeton and his theory of continuous particles is well known among scientists.[93]

In addition to founding the Telecommunication Center of Asad-Abad in Hamadan, Hessabi's achievements on space and related technologies include establishing the first modern observatory of Iran in 1945 and establishing the satellite tracking center of Iran in 1957, both in Shiraz, founding and heading the Geophysical Institute of the University of Tehran from 1951 to 1965,[94] and representing Iran on the Scientific and Technical Subcommittee of the United Nations Committee of the Peaceful Uses of Outer Space (COPUOS) from 1962 to 1968.[95,96] He also instigated Iranian membership of the Committee on Space Research (COSPAR) and represented Iran at UNISPACE-82 (United Nations Second International Conference on the Exploration and Peaceful Uses of Outer Space in 1982).[97]

3.1 Mahmoud Hessabi (1903-1992) in his office at the Physics Department at the University of Tehran. Born in Tafresh, he was a distinguished polymath who studied different fields including space science and technology. [Professor Hessabi Foundation]

Another prominent dignitary in the field is Alenush Terian (1920-2011), an Iranian astronomer and physicist born to an Armenian family. After graduating in physics from the University of Tehran in 1947, she studied atmospheric physics at the Sorbonne in Paris, from which she graduated in 1956. On returning to Iran, she worked as an assistant professor in thermodynamics at the University of Tehran. In 1964 she became the first female professor of physics in Iran, and in 1966 she gained membership of the Geophysics Committee at the University of Tehran. She was awarded the title of 'Mother of Modern Iranian Astronomy'. She was one of the founders of the solar observatory of the Institute of Geophysics at the University of Tehran, where she also worked until her retirement in 1979.[98]

Yousef Sobouti (b.1932) gained a PhD in astrophysics at the University of Chicago in the USA and founded the Institute for Advanced Studies in Basic Science (IASBS) in Zanjan. In 1977, he founded the Abu Reihan-e Biruni Observatory of Shiraz University. This is now the most active observatory in Iran. In recognition of his scientific activities, in 2000 he was awarded the special prize of the Third World Academy of Science (TWAS).[99] In 2010 his dismissal from the directorship of the IASBS after years of undeniable scientific and cultural services to the Iranians and Iran prompted public outrage.

3.2 Alenoush Terian (1920-2011), an Iranian astronomer and physicist at the University of Tehran. Born in Tehran to an Armenian family, she is known as the 'Mother of Modern Iranian Astronomy'. [*Hamshahri Daily*]

3.3 Yousef Sobouti (b.1932), an Iranian physicist and astronomer. Born in Zanjan, he founded the Institute for Advanced Studies in Basic Sciences (IASBS). [Wikipedia]

Farhad Ardalan (b.1939) is an Iranian high energy physicist. He is known for his proposal of the para-string theory, construction of modular invariant partition functions for WZNW models (i.e. the Wess-Zumino-Novikov-Witten model that is a simple model of conformal field theory) through the orbifold method (an orbifold is something with many

folds), classification of 11-dimensional super-gravity solutions with a quotient structure, and his discovery of non-commutativity in the D-branes of string theory. He is also known for his research in superstring theory and Yang-Mills theory. He and prominent Iranian physicists and cosmologists such as Reza Mansouri (b.1948) and Mehdi Golshani (b.1939) have been among the main architects of theoretical physics in Iran.[100]

Iraj Malekpour (b.1940) is an Iranian scientist of space geophysics and astronomy who gained his education in France and became famous in Iran for writing and preparing the annual calendar that was officially used there until 2002. In addition to the University of Tehran, he worked as the head of the Solar Physics and Astronomy Division of the Institute of Geophysics of Tehran University. In 2007, after years of noteworthy scientific and cultural services to the country, he was purged from both the university and the institute.[101]

Homayoun Seraji (1947-2007) was an Iranian aerospace scientist and engineer, a senior researcher at NASA's Jet Propulsion Laboratory (JPL), and former professor of Sharif University of Technology who published extensively in the field of multi-variable control systems. He earned his PhD in control systems at the University of Cambridge in England in 1972. Two years later he joined the Aryamehr University of Technology (currently the Sharif University of Technology) as a professor of electrical engineering and was involved in teaching and research in control systems for ten years. He was also named a United Nations Distinguished Scientist in 1984. In 1985 he joined the California Institute of Technology (Caltech) and JPL. During his tenure at JPL, he conducted extensive research that led to major contributions in the field of robotic control systems, particularly in

3.4 Reza Mansouri (b.1948), an Iranian physicist and astronomer who was born in Tehran and founded the Iranian National Observatory. [Personal website of Prof. Reza Mansouri]

adaptive robotics, control of dexterous robots, contact control, real-time collision avoidance, rule-based robot navigation, and safe spacecraft landing.[102]

Reza Mansouri (b.1948) is an Iranian physicist and astronomer who gained a doctorate in physics and astronomy at the University of Vienna in Austria in 1972. He became one of the leading scientific policy-makers in Iran and was the Deputy Minister of Science from 2001 to 2005. He made possible Iran's participation in several major international scientific projects such as SESAME (Synchrotron Light for Experimental Science and Applications in the Middle East) and the Large Hadron Collider particle accelerator at CERN (Centre Européenne pour la Recherche Nucléaire) in Geneva. He has a number of publications that focus on scientific development in Iran, and has been awarded scientific prizes, including the highly acclaimed Abdus Salam prize. Mansouri has served as President of the Physical Society of Iran (PSI) and is one of the founders of the Institute for Studies in Theoretical Physics and Mathematics (ISTPM), currently known as the Institute for Research in Fundamental Sciences (IRFS), where he heads the Astronomy School that is responsible for the 3.4m telescope of the Iranian National Observatory (INO).[103,104]

The abovementioned dignitaries are just the most prominent of a large group of space physicists, astronomers and aerospace engineers in Iran who promote the teaching of space science and space technologies. Over recent decades, they and the eager students that they taught have produced many scientific and engineering achievements.

3-1 ACADEMIC EDUCATION AND RESEARCH, THE FOUNDATION FOR MASTERING SPACE

In recent decades, Iran has worked on basic capacity building in space science and technology by developing education and training in the domains of aerospace, space sciences and aeronautics at graduate and postgraduate levels in support of the development of space applications and industrial activities. A significant number of its leading universities and scientific institutions are involved in teaching air and space sciences and technologies, as well as applications in remote sensing, satellite telecommunications, and global positioning systems. In addition, administrative bodies such as the National Cartographic Center, the Iranian Space Agency, and the Soil Conservation and Watershed Management Research Center are all providing discipline-oriented or special courses on new space technologies. The country expects that the new generation of scientists, experts and educated human resources in space science and technology will play an evolving and long-lasting role in exploiting those fields in a sustainable manner that benefits its citizens.

Table 3.1 lists the universities and academic institutions in Iran that are involved in education and research in space science and technology. In terms of importance and development, about 80% are in Tehran but the provinces of East Azerbaijan, Isfahan, Fars, Zanjan, Kerman, Khuzestan and Ghazvin also host research institutions and universities involved in space science and technology education. To extend existing knowledge, Iranian space specialists regularly participate in courses supported by the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and offered by other regional or international bodies such as the United Nations regional Centre for Space Science and Technology Education in Asia and the Pacific (CSSTE-AP), the Inter-Islamic

Table 3.1. Space science and technology education and research in Iran. Iran has a large network of private, public, and state affiliated universities offering degrees in space sciences and technology, including aerospace, astronomy and astrophysics, satellite communications, remote sensing and global positioning systems. The state-run (technical) universities of Iran are under the direct supervision of the Ministry of Science, Research, and Technology (MSRT). B=bachelor's degree, M=master's degree, D=PhD degree. [Author]

University/Institution	*Location*	*Degree*
Sh. Chamran University of Ahvaz	Ahvaz/	B, M
– Physics Department / Remote Sensing Department	Khuzestan	
Malek Ashtar University of Technology (MUT)	Isfahan/Isfahan	B, M
– Department of Mechanical and Aerospace Engineering		
University of Isfahan (UI)	Isfahan/Isfahan	B, M
– Surveying Department		
University of Kashan	Kashan/Isfahan	B
– Department of Astronomy		
International Center for Science and High Technology and Environmental Science (ICSHTES)	Kerman/Kerman	M
– Research Institute of Environmental Sciences		
Islamic Azad University of Maragheh	Maragheh/East	B
– Department of Astronomy Physics	Azerbaijan	
Research Institute for Astronomy and Astrophysics of Maragheh (RIAAM)	Maragheh/East Azerbaijan	D
Imam Khomeini International University (IKIU)	Qazvin/Qazvin	M
– Astronomy and Astrophysics Department		
Shiraz University	Shiraz/Fars	M, D
– Department of Physics		
Shiraz University of Technology	Shiraz/Fars	M, D
– Faculty of Mechanical Engineering and Aerospace		
Tabriz University	Tabriz/East	M
– Faculty of Human and Social Sciences	Azerbaijan	M, D
– Faculty of Electrical Engineering		M, D
– Faculty of Physics		M, D
– Research Institute Applied Physics and Astronomy (RIAPA)		
Aerospace Research Institute (ARI)	Tehran/Tehran	M, D
Alzahra University	Tehran/Tehran	M, D
– Physics Department		
AmirKabir University of Technology (AUT)	Tehran/Tehran	B, M
– Aerospace Engineering Department		B, M
– Physics Department		
Civil Aviation Technology College (CATC)	Tehran/Tehran	B
– Aviation Communication Engineering Department		
Imam Hossein University (IHU)	Tehran/Tehran	B, M
– Department of Aerospace Engineering		
Iran University of Science & Technology (IUST)	Tehran/Tehran	B, M, D
– Department of Electrical Engineering		
Islamic Azad University, Science and Research Branch (SRBIAU)	Tehran/Tehran	B, M
– Department of Aerospace Engineering		

Table 3.1 *cont.*

University/Institution	*Location*	*Degree*
K.N.Toosi University of Technology (KNTU)	Tehran/Tehran	B, M
– Faculty of Aerospace Engineering		B, M
– Communication Department		B, M, D
– Geodesy and Geomatics Faculty		
Shahid Beheshti University (SBU)	Tehran/Tehran	M
– Department of Remote Sensing and GIS		
Sharif University of Technology (SUT)	Tehran/Tehran	B, M, D
– Department of Aerospace Engineering		
Tarbiat Modares University (TMU)	Tehran/Tehran	M
– Department of Geography		
University of Tehran	Tehran/Tehran	B, M
– Institute of Geophysics (Solar Physics and Astronomy Section)		B, M, D
– Department of Surveying and Geomatics Engineering (Remote Sensing Division)		
Institute for Advanced Studies in Basic Science (IASBS)	Zanjan/Zanjan	M, D
– Department of Physics		
University of Zanjan	Zanjan/Zanjan	M, D
– Physics Department		

Network on Space Sciences and Technology (ISNET), and the Japan International Cooperation Agency (JICA). Various seminars, symposia, conferences and workshops also play an important role in promoting the existing expertise of Iranian scientists.[105]

3-1-1 Universities and entities related to space education

Iran has a large network of private, public, and state affiliated universities offering degrees in space sciences and technology, including aerospace, astronomy and astrophysics, satellite communications, remote sensing, and global positioning systems. State-run (technical) universities of Iran are under the direct supervision of the Ministry of Science, Research and Technology (MSRT).

Amir-Kabir University of Technology: Aerospace Engineering Department and Physics Department

The Amir-Kabir University of Technology, formerly known as Tehran Polytechnic, is in Tehran. Its Aerospace Engineering Department opened in 1984 by admitting 25 students for a bachelor's degree. As such, it was the first independent institute in aerospace engineering in Iran. It started presenting courses for a master's degree in 1992 in four major fields of study: aerodynamics, propulsion, flight dynamics-control, and aerospace structures. In 2012 it added a new course in space engineering and satellite technologies. In the future, it plans to make use of virtual training to expand its coverage to include aeronautical engineering. The Aerospace Engineering Department is active in many research areas and industrial projects. There are several advanced research laboratories and workshops within the department and it has been recognized by the Ministry of Science, Research and Technology as a center of excellence in computational aerospace engineering.

Its successes are the result of activities and contributions by academic members, students and staff of the faculty in improving the quality of education and facilities of the department.[106] The department has the privilege of hosting facilities such as the Engine & Airframe Workshop and Aerodynamics Laboratory which has a subsonic wind tunnel and a constant-temperature anemometer to accurately measure air speeds.[107] It also operates Control, Composite, Computational Fluid Dynamics, Dynamic Systems and Vibration, Experimental Aerodynamics, Fatigue and Fracture, Flight Dynamics, Fuel and Combustion, Hardware In-loop, and Virtual Reality Research Laboratories.[108] In the near future, the Aerospace Engineering Department and the Physics Department plan to offer a joint program in the field of cosmology and astrophysics.

University of Tehran: Faculty of Science and New Technologies, the Solar Physics and Astronomy Section of the Institute of Geophysics, and the Remote Sensing Division of the Department of Surveying and Geomatics Engineering in the Engineering Faculty
The University of Tehran is the oldest (1934) and largest scientific, educational and research center in Iran, and is known as the Mother University or the Symbol of Higher Education of the Country. It is considered one of the nation's pioneers in important scientific, cultural, political and social affairs. The Faculty of Science and New Technologies participates in the education of aerospace engineering at the doctoral level. At the master's level it teaches space engineering, aerodynamics, aerospace structures, aircraft accidents and flight qualification, propulsion, flight dynamics and control. The Solar Physics and Astronomy Section was established at the Institute of Geophysics of the University of Tehran in 1963. It has gradually developed into a center for research in different fields of astronomy, solar and solar-terrestrial studies, and the magnetic storms on the Earth which are caused by the Sun. A solar observatory gives short-term training programs, as well as allowing visitors to observe the Sun. This section supports the extension of the research and education programs to master's and PhD levels in astronomy and astrophysics. Established in 1998, the Remote Sensing Division at the Department of Surveying and Geomatics Engineering in the Engineering Faculty at the University of Tehran carries out research and education to master's and PhD level in space technology applications such as remote sensing and photogrammetry. The division's training and research activities have been continued by establishing the Remote Sensing Laboratory which is the core of all the division's research activities. The laboratory has facilities for both master's and PhD students, and as a center for remote sensing it includes an archive of satellite images.[109]

Sharif University of Technology: Department of Aerospace Engineering
The Sharif University of Technology (SUT), formerly the Aryamehr University of Technology, is in Tehran. In 1987 the Aerospace Engineering Group of the Mechanical Engineering Department began offering degree courses. In 1999 this became the independent Department of Aerospace Engineering. According to the general vision of the university, the faculties of aerospace engineering are amongst the world's most prestigious, providing an atmosphere of expertise and collaboration. The Department of Aerospace Engineering works closely with the Departments of Mechanical Engineering, Applied Physics, and Electrical Engineering. It aims to be a leader in education and research. Its educational mission is to contribute to the community through excellence in education, research, and training of future leaders of industry, academia, government and society.

3.5 The Department of Aerospace Engineering, Sharif University of Technology (SUT). [SUT]

Its academic programs are designed to provide students with essential fundamental knowledge, analytical skills, creativity, perspective, and ethics. Its bachelor's level program is designed to give students knowledge of science, mathematics, and engineering, and provide them with the capacity to work effectively in engineering and related multidisciplinary fields. The graduate program aligns academic course work with research to prepare specialists, professionals, and scholars in specialized areas within the field of aerospace engineering. Research topics focus on the industrial needs of the country and contribute to its economic and social development. The teaching and research programs in the department cover all of the core disciplines of aerospace engineering, including aerodynamics, propulsion, energy conversion systems, flight dynamics and control, structures and airplane design. In-house laboratories work in association with industrial laboratories to provide easy access to the facilities in a number of areas, including spray phenomenon, combustion, acoustics, turbo-machinery, and subsonic/supersonic wind tunnels. The research laboratories of the department include Aerodynamics, Aerospace Structures, Combustion, Flight Dynamics, High Performance Computing, Precise Elements Shop, and Thermodynamics.[110]

Khajeh Nasir-e Tusi University of Technology (KNUT): Faculty of Aerospace Engineering and Faculty of Geodesy and Geomatics

The Faculty of Aerospace Engineering of the Khajeh Nasir-e Tusi University of Technology was established independently in 2005 as the third aerospace faculty in Iran. It was an expansion of the Aerospace Group created in the Faculty of Mechanical Engineering in 2000. This group launched its activities with aerospace master's courses in the disciplines of aerodynamics, propulsion, aerospace structures, and flight dynamics and control. The following year, it added a fifth master's level course in space machinery engineering. A joint bachelor's course in aerospace engineering was introduced with Moscow Aerospace Technology University in 2004. The joint program was also offered at the doctoral level.

The department also offers a doctoral level in aerospace engineering in propulsion and flight dynamics and control. In addition, there are short-term and long-term courses in the design of space machinery systems (satellites), multidisciplinary design optimization for optimal systems and propulsion systems, analysis of instability in combustion and operators, computational fluid dynamics, flight simulation, design and analysis of guidance systems and flight controls, gyroscope mechanisms, systems of aerospace structures and operators.[111] The Communications Department in the Faculty of Aerospace Engineering also offers bachelor's and master's programs in satellite communications. In addition, the Faculty of Geodesy and Geomatics of the Tehran-based Khajeh Nasir-e Tusi University of Technology offers master's and PhD programs in remote sensing and geographical information systems.

Malek Ashtar University of Technology (MUT): Department of Mechanical and Aerospace Engineering

The Malek Ashtar University of Technology has branches in Tehran and Isfahan and is involved in non-civilian aerospace research and education. In 1986, the then-Ministry of Culture and Higher Education established the Department of Mechanical and Aerospace Engineering with a bachelor's level course of mechanical engineering in the design of rigid bodies. The following year it added a bachelor's level course in aerospace engineering. In 2009, to comply with the requirements of the Ministry of Defense and Armed Forces Logistics (MODAFL) the structure and organization of the Department of Mechanical and Aerospace Engineering was upgraded to an academic complex. In the quarter of a century since its establishment, the complex continues its activity in the framework of a faculty, a research institute, and six scientific departments with more than 400 students at bachelor's, master's and doctoral levels.[112] It has departments for Space Systems Design, Aerodynamics, Flight Dynamics, Space Structures, Space Propulsion, and Guidance, Control and Navigation.[113]

Iranian University of Science and Technology (IUST): Department of Aerospace Engineering and Department of Electrical Engineering

Known as Elm-o Sanat University of Iran, the Iranian University of Science and Technology is one of the major technical universities in the country. It was conceived in 1929 and currently consists of 14 schools and departments. The main campus is located in Tehran, but there are branches in Arak and Behshahr. The Department of Electrical Engineering provides research and educational programs at bachelor's, master's and PhD levels in communications topics, including satellite communications. The Power Electronics, Electrical and Magnetic Fields Research Laboratory is pursuing research into the propagation of electromagnetic fields in space. The Department of Aerospace Engineering is one of the Mechanical Engineering schools, and offers graduate level aerospace engineering courses in the fields of aerodynamics, propulsion, and air structures.

Shahid Beheshti University (SBU): Department of Aerospace Engineering and the Department of Remote Sensing and GIS in the Faculty of Earth Sciences

The Shahid Beheshti University was established in 1959 in Tehran as the National University of Iran, and began its academic activity in 1960. Its Department of Aerospace Engineering is now part of the Faculty of Energy and New Technologies Engineering that

was established in 2007 by the admission of 15 master's students. The Department of Remote Sensing and Geographical Information Systems in the Faculty of Earth Sciences offers research and educational programs at master's level. In 1999 the Remote Sensing and Geographical Information Systems Research Center was established in the Earth Sciences Faculty with three subsections that are Remote Sensing, Geographical Information Systems, and Global Positioning Systems with the goal of improving expertise in the application of geometric technologies.[114]

Tarbiat Modarres University (TMU): Department of Aerospace Engineering and the Department of Geography in the Faculty of Humanities

The Tarbiat Modarres University was founded in 1982 in Tehran in the wake of the formation of the Islamic Republic of Iran. Its main goal is to train academic staff and researchers to the educational requirements of the country's universities and academic centers. It provides an environment which promotes a high level of professional performance for students from various backgrounds and areas. The Department of Aerospace Engineering that offers courses at the graduate level is actually one of the schools in the Mechanics Section of the Department of Technology and Engineering. In addition, the Department of Geography in the Faculty of Humanities offers master's programs in remote sensing and geographical information systems, focusing on technology applications.[115]

University of Tabriz: Faculty of Human and Social Sciences, the Faculty of Electrical Engineering, the Faculty of Physics, and the Research Institute for Applied Physics and Astronomy (RIAPA)

The University of Tabriz, formerly Azarabadegan University, was established in 1946. Its Faculty of Human and Social Sciences offers master's programs in remote sensing and geographical information systems. The Faculty of Electrical Engineering has master's and PhD programs in communications using space. The Faculty of Physics provides master's and PhD research and education programs in astrophysics. The Research Institute for Applied Physics and Astronomy (RIAPA) was established at the university in 1972 in order to develop research and promote the institute in terms of both quantity and quality in various fields of applied physics. The Institute's Department of Astronomy conducts research in astronomy and astrophysics with students working for master's and PhD degrees.[116,117]

Islamic Azad University of Tehran, Sciences and Research Branch (SRBIAU): School of Mechanical and Aerospace Engineering

The Schools of Mechanical Engineering and Aerospace Engineering were independently founded in 1994 as a subset of the Faculty of Technology and Engineering. Owing to the wide range of activities and the large numbers of the students and tutors, and also due to commonality in fields of activity, in 2008 the two schools were merged to establish the School of Mechanical and Aerospace Engineering offering bachelor's and master's degrees.[118]

University of Shiraz: Department of Physics and Department of Aerospace Engineering and Energy

The University of Shiraz is one of the high-ranking universities of Iran. Its initial nucleus was formed in 1946. The Department of Physics in the Faculty of Science offers master's

and PhD programs in astrophysics. The Department of Aerospace Engineering and Energy is in the Faculty of Engineering and provides graduate level education of aerospace.[119]

Shiraz University of Technology (SUTECH): Mechanical and Aerospace Engineering Department
In 2004 the Electrical Engineering College of the University of Shiraz was awarded independence as the Shiraz University of Technology (SUTECH). It is the second state institute in the Fars Province in higher technological education and basic and applied research. Since 2006 the Faculty of Mechanical Engineering and Aerospace has offered research and educational programs at master's and PhD levels in aerospace and mechanics, focusing on energy transfer.[120]

Ferdowsi University of Mashhad (FUM): Department of Aerospace Engineering
In the Ferdowsi University of Mashhad, the Department of Aerospace Engineering forms part of the Department of Mechanical Engineering in the Faculty of Engineering. It is involved in the graduate level education of aerospace in the fields of aerodynamics, air structures, and propulsion.

Imam Hussein University (IHU): Department of Aerospace Engineering
The Imam Hussein University in Tehran was established in 1986 and is affiliated with the Guardian Corps of the Islamic Revolution, usually called the Pasdaran. Its Faculty of Engineering contains the Department of Aerospace Engineering. This conducts both undergraduate and graduate programs in aerospace engineering.[121]

Shahid Sattari University of Aeronautical Engineering: Faculty of Aerospace
The Shahid Sattari University of Aeronautical Engineering, also known as the Shahid Sattari Air University, was established in Tehran in 1988 by Shahid Mansour Sattari. It includes the Faculty of Flight, the Faculty of Air Command and Control Technology, the Faculty of Electrical Engineering, and the Faculty of Aerospace, which offers training for aircraft maintenance and aerospace cadets to bachelor's level.

Civil Aviation Technology College (CATC): Aviation Communication Engineering Department
Since 1949 the Civil Aviation Technology College in Tehran has provided training in the exchange of messages and navigation data through switching systems, telex, microwave circuits and satellites, and the operation and maintenance of transmission and communication systems. It offers programs at the bachelor's level in the fields of atmospheric and aviation communications using satellites.[122]

Institute for Advanced Studies in Basic Science (IASBS): Department of Physics
The Institute for Advanced Studies in Basic Science is based in Zanjan and focuses on research and education in basic sciences at postgraduate level. It started in 1992 with the Physics Department. Its education and research programs include theoretical condensed matter physics, mathematical physics and astrophysics. In 2000, a 7-year program began in which students follow their undergraduate and graduate courses with a PhD thesis, thereby skipping the master's thesis. The Physics Department is currently the only place in Iran to offer such a program. It also offers master's and PhD programs in astrophysics.[123]

University of Zanjan: Physics Department
The Physics Department of the University of Zanjan began its activity in 1991. Its main focus is astrophysics and it offers master's, PhD and research programs in astrophysics and astronomy.[124]

Imam Khomeini International University (IKIU): Astronomy and Astrophysics Department
The Imam Khomeini International University was established in 1992 in Ghazvin by a merger of the Iran International Islamic University with the Dehkhoda Higher Education Institute. The Astronomy and Astrophysics Department in the Faculty of Basic Sciences offers master's degrees in astronomy and astrophysics.[125]

Shahid Chamran University of Ahvaz: Physics Department and Remote Sensing Department
The Physics Department in the Faculty of Science of the Shahid Chamran University of Ahvaz was established in 1970. It offers research as well as bachelor's, master's and PhD degrees in astrophysics and radio astronomy. The Remote Sensing Department in the Faculty of Science was established in 2001 and offers bachelor's and master's degrees in remote sensing technology.[126]

University of Isfahan (UI): Surveying Department
Established in 1950, the University of Isfahan is one of the major universities in the fields of science, human science, and engineering. The Surveying Department of the Technical and Engineering Faculty was established in 1988 and offers master's degrees in remote sensing.[127]

University of Kashan: Department of Astronomy
The University of Kashan was founded in 1974. At that time it offered only undergraduate courses in physics and mathematics. Its current activities are classified into four sections of education, research, development, and side activities. The observatory of the University of Kashan, which was established by the Department of Astronomy in 2000, is involved in the teaching of astronomy and astrophysics at bachelor's level. One of the most important observatories in the country, it has seven telescopes with the variety of apertures.[128]

Alzahra University: Physics Department
The Alzahra University, formerly the Farah Diba University, was founded in 1964 in Tehran and is exclusively for women. It began as the Higher Education Institute for Girls. The name was changed to Alzahra University following the establishment of the Islamic Republic of Iran in 1979. The Physics Department in the Faculty of Science was established in 1977 and offers master's and PhD degrees in astronomy and astrophysics.[129]

Islamic Azad University of Maragheh: Department of Astronomy Physics
Established in 1985 the Islamic Azad University of Maragheh offers a variety of educational programs in science and engineering. The Department of Astronomy Physics offers programs for bachelor's and master's degrees in astronomy and astrophysics. It is the only entity amongst all of the Islamic Azad Universities throughout Iran to offer such an educational program.[130]

National Cartographic Center (NCC)
The National Cartographic Center, which has half a century of experience in map-making, currently works under IR Iran President Deputy of Planning and Strategic Supervision, and is responsible for planning, directing, standardizing and supervising the production of base maps and spatial data. In addition, it is utilizing satellite navigation for projects such as the Triangulation Networking and the National Leveling Project and its subsequent linkage with regional and international GPS networks. It also uses GPS in the national 1:25,000 scale Topographic Mapping Project, the Determination of the Geoid of Iran, and miscellaneous geodesic surveying and accurate leveling projects.

Soil Conservation and Watershed Management Research Institute (SCWMRI)
The SCWMRI of the Agricultural Research and Education Organization (AREO) is the focal point for soil conservation, watershed management, flood management and exploitation, river engineering and training, coastal protection, hydrology, and water resources development in the Ministry of Jihad of Agriculture. It operates in cooperation with many universities, but principally with the University of Tehran.

3-1-2 Research Centers

Aerospace Research Institute (ARI)
The Aerospace Research Institute was established in 2000 by the Ministry of Science, Research and Technology of Iran, but is currently affiliated to the Iranian Space Agency working under the agency's Space Research Center as the Astronautics Research Institute. Its achievements, sources and expertise supports researchers and master's and PhD students in air and space science and technology.[131]

Space Research Institute (SRI)
The Space Research Institute was founded in 2007 by the Iranian Space Agency on the authorization of the Council of Developing Higher Education. It pursues the objectives and responsibilities of the Iranian Ministry of Science, Research and Technology as well as its own statute, which mandates it to abide by the regulations, provisions and approved circulars of the Ministry of Science, Research and Technology and related entities. SRI currently works under the Space Research Center of ISA.[132]

Research Institute for Astronomy and Astrophysics of Maragheh (RIAAM)
The Research Institute for Astronomy and Astrophysics of Maragheh was created in 2002 to revive the science and research functions of the Maragheh Observatory, which was built by the famous scientist and astronomer Khajeh Nasir al-Din al Tusi in 1259 and was active for half a century. It contributes to the production and introduction of up-to-date science in astronomy and cosmology, and doing research projects at the international level. It offers education and research programs at postgraduate (PhD and post-doctoral) levels in astronomy and astrophysics. Its mandate is to develop research in the fields of astronomy, astrophysics, cosmology and the related technologies; to employ and organize researchers and provide their scientific and convenience needs; to recognize and supply the scientific and research requirements of other institutions that are involved in similar activities; to communicate and mutually exchange experience and knowledge with internal and foreign

3.6 The Research Institute for Astronomy and Astrophysics of Maragheh was created in 2002 to revive and introduce the science and research mission of the Maragheh Observatory. [RIAAM]

research centers; and to present higher education and research programs in astronomy and related subjects, along with holding short courses and workshops for educational and research purposes.[133]

Research Institute of Environmental Sciences, International Center for Science and High Technology and Environmental Science (ICSHTES)
The International Center for Science and High Technology and Environmental Science in Kerman was created in 1996 and focuses on the use of new and advanced technologies for studying and monitoring of the environment. The Research Institute of Environmental Sciences uses remote sensing and GIS technologies in environmental studies and modeling and supports master's degrees in environmental studies.[134]

3-1-3 Observatories and astronomy

Astronomy is one of the favorite sciences of the Iranian people, not only in contemporary times but for millennia. It has had a mutually beneficial relationship with sciences such as geometry, trigonometry, physics and mechanics, and has also strongly influenced art and literature. An observatory is a facility for observing, studying and measuring the celestial phenomena. Originally, observatories made use of sextants and other simple tools. A modern observatory typically uses either a large optical telescope in a rotating dome or a radio telescope that might or might not be able to rotate.

It is believed from a number of historic and research records that the first Iranian observatory was founded in Baghdad in 828 AD (212 AH) and was operated by two eminent astronomers, Fazl Ibn-e Novbakht-e Ahvazi and Muhammad Ibn-e Mousa al-Khawrazmi. Others believe that the first Iranian observatory was built by Haaseb Tabari-e Amoli. However, recent archeological discoveries indicate that the oldest observatory on the

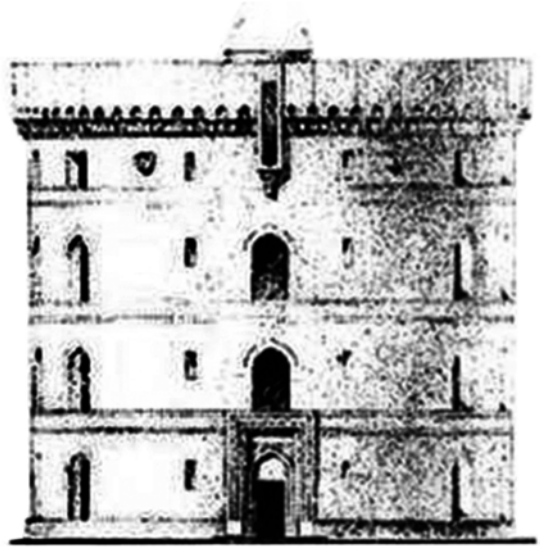
Iranian territory is the Observatory of Gur (currently Firouz Abad) located in the Fars Province of Iran. It was discovered in 2006 during excavations made by the joint Iran-Germany archaeological team headed by Professor Dietrich Hoff.[135] Records indicate that this observatory was active around 300 AD in the Sassanid Era. After the abovementioned observatories, numerous others were built around the country, each related to a prominent Iranian astronomer; one being the Bethanie Observatory in Ragheh and another the Abd ul-Rahman-e Soufi Observatory in Shiraz. After the 10th century, observatories were associated with princes and kings, for example the Ala al-Dovleh Observatory in Hamadan that was built for Avicenna. Less than a century later Malek Shah-e Saljughi founded a major observatory in which worked dignitaries such as Umar Khayyam-e Neishaboori, who designed the Jalali calendar, the most accurate calendar in the world. Discovery of the Observatory of Gur is an indication that astronomy in Iran is more deeply rooted than was initially thought, and it was a well-developed pre-Islamic science in Persia. It was the importance of astronomy for Iranians that in the post-Islamic era the rulers in Iran, whether Muslim or non-Muslim, attempted to build observatories and support astronomers and astrology; they clearly recognized the benefits of astronomy.

The development of Iranian observatories culminated with the Maragheh Observatory, which was the most prestigious observatory in the world in the Middle Age. Construction began in 1259 AD (655 AH) by the Iranian scientist and astronomer Khajeh Nasir al-Din al-Tusi (1201-1274) on the orders of Hulaku (1217-1265), the grandson of the Mongol Emperor Genghis Khan, who assigned endowments to manage and protect this research foundation. It was equipped with a library of 40,000 books and astronomical instruments that included a wall quadrant (Zat-ul Robe) with a radius of 430cm, ringed spheres

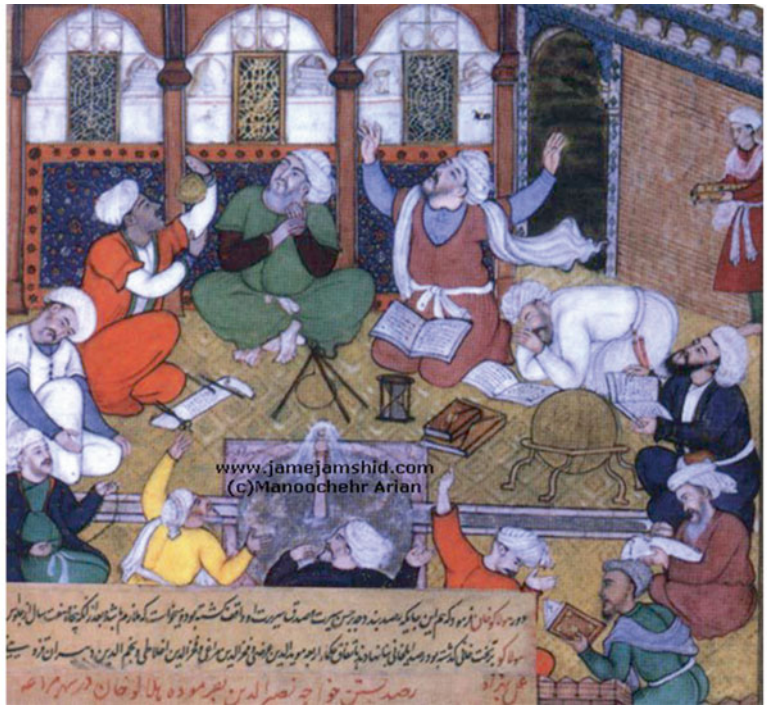
3.7 An aerial view of the remnants of the very precise circular city of Gur in the Fars Province of Iran. It was built about 224 AD by Ardeshir-I (Artaxerxes), known as Ardeshir Babakan, the first king (226-241) and founder of the Sassanid dynasty. The circular vallum with a diameter of exactly 1940m that surrounds the town is notable. [Mehr News Agency]

3.8 Remnants of the Observatory of Gur located in the Fars Province of Iran. It was active around 300 AD in the Sassanid Era, and is the oldest known Iranian observatory. [Parsa City]

3.9 A portrait of Khajeh Nasir al-Din al-Tusi (1201-1274), the founder of Maragheh Observatory. [Ismaili Web Amaana]



3.10 A sketch of Maragheh Observatory. It was a four-story circular stone building with a diameter of 28m on a rectangular site. The mural quadrant used to observe the positions of the stars and planets was aligned with the meridian, which served as Prime Meridian (reference meridian) for the tables in the *Zij-e Ilkhani*. [*Azerbaijan International*]



3.11 A picture from the book *Zij-e Ilkhani* written by Khajeh Nasir al-Din al-Tusi showing work at the Maragheh Observatory. Other major members were Mu'ayyid al-Din Orouzi, Fakher al-Din Maraghi, Fakher al-Din Ekhlati, Najm al-Din Dabiran. [*Jam-e Jamshid*]

(Zat-ul Halgh), and ring of revolution and sky ring. It was in the Maragheh Observatory that the astronomical almanac known as the Ilkhanid Astronomical Table (Zij-e Ilkhani) was prepared in 1276 AD (670 AH). According to archaeological and historical studies, as well as an examination of the remnants of the observatory, it was a four-story circular stone building with a diameter of 28m on a rectangular citadel-like area of 340×135m. The mural quadrant to observe the positions of the stars and planets was aligned with the meridian, which served as Prime Meridian (reference meridian) for the tables in the *Zij-e Ilkhani*.[136]

Hulaku believed that much of his military success was due to the advice of astronomers (who were also astrologers), especially Khajeh Nasir al-Din al-Tusi, who persuaded him that he could only guide the destiny of the Mongols if a major observatory was constructed with a library to house an enormous number of books. Furthermore, Khajeh Nasir added, the astronomical tables were out of date. Hulaku duly authorized the building the observatory in a place of Khajeh Nasir's choice. According to books such as *Rashidi's Jam-e-ttavarikhe*, the Maragheh Observatory became operational in 1262, and was equipped with instruments invented by Khajeh Nasir himself. The observatory was not merely a site for observing the sky, it was a scientific center in which most branches of knowledge were taught by the most famous scientists of the age, such as Qutb al-Din al-Shirazi, who correctly explained why a rainbow forms.[137] Many nationalities including Arabs, Azerbaijanis, Chinese, Georgians, Mongolians, Persians, Turks, and Jews were involved with the work of the Maragheh Observatory, which was the largest of its kind in the world prior to the invention of the telescope for astronomical studies.

Many prominent astronomers worked there, for example Muhyi al-Din al-Maghribi and Mu'ayyid al-Din al-Urdi from Damascus. Furthermore, since at that time both China and Iran were governed by the Mongols, Chinese scientists such as Foal Munji were able to travel freely to Iran to work in the observatory. Foal Munji's Chinese astronomical

3.12 A close view of the Maragheh Observatory. [Author]

3.13 A long-range view of the Maragheh Observatory settling over the hill Talebkhan. The dense green area behind is the famous gardens of Maragheh. [Reza Effati @ Panoramio]

experience brought improvements to the Ptolemaic system used by Khajeh Nasir. In addition, the Christian philosopher and encyclopedist Ibn il-Arabi taught the Euclidian principles and the Al-Majasty of Ptolemy at the observatory. It fully lived up to Khajeh Nasir's vision of a multinational center. He was a man of exceptionally broad knowledge. He wrote on astronomy, physics, medicine, philosophy, ethics and logic, and made the most significant enhancement of Ptolemy's model of the system of planetary motions prior to the announcement by Copernicus of the heliocentric hypothesis in his 1543 book *De Revolutionibus*.[138]

Iranian observatories flourished in the 15th century, when Ulugh Beig, the grandson of Tamerlane, built one in Samarkand. Along with the Observatory of Istanbul, it set the style for later European observatories. A competent astronomer, Ulugh Beig employed the best mathematicians of the time, most notably Ghyas ud-Din Jamshid-e Kashani, and provided them with advanced research tools, in particular an arc of the meridian which stood 50m tall.

Interest in astronomy continues in Iran, with the academic and scientific sectors founding modern observatories which, whilst not large, offer the possibility of research mainly in the optical spectrum and to a lesser extent in the microwave region. The current domestic observatories (listed below) will be further developed to enable astronomers to carry out advanced observations. Local non-governmental astronomical societies and centers in Iran are carrying out a broad program in conjunction with international astronomical societies to promote astronomy in Iran. In addition to the Iranian Society of Astronomy, which is active on a national level and affiliated with the Ministry of Science, Research and Technology, the other active NGOs in this connection are the Adib Astronomical Education Center, the Hedaytgaran-e Andisheh Research Center, the Shiraz Astronomy Society, the Iranian Akhtar-vash Society, the Hakim Umar Khayyam Society (Nishaboor), the Sh. Hashemi Nejad Society (Sabzevar), the Noor Society (Ghom), the She-ri Society, the Shrine of Hazrat Abdul Azim Astronomical Society (Rey-Tehran), the Isfahan Optics Industries, and the Shiraz Akhtar-nama Corporation.[139]

Iranian observatories

There are currently more than 20 active observatories in Iran, located in Tehran, Tabriz, Mashhad, Shiraz, Isfahan, Ahwaz, Kashan, Kerman, Gorgan, Yazd, Damghan, Zanjan, Ilam, Kermanshah and some other cities, and they are active in research and education.

- *Observatory of the University of Tabriz,* known as the *Khajeh Nasir-e Tusi Observatory*, is currently the greatest observatory center of Iran.
- *Abu Reihan-e Biruni Observatory* at Shiraz University was founded in 1977 by Professor Yousef Sobouti (b.1932) and is currently the most active observatory of the country. It is equipped with a 50cm reflective telescope.
- *Kashan University Observatory* is equipped with a 40cm reflective telescope.
- *Zanjan University Observatory* is equipped with a 40cm reflective telescope.
- *Shrine of Hazrat Abdul Azim Observatory*, Rey-Tehran, is equipped with an 18in refractive telescope, making it the biggest refractive observatory of Iran.
- *Zafaraniieh Observatory of Tehran* is affiliated with the Institute for the Intellectual Development of Children and Young Adults of Iran. It is equipped with a 10in Meade telescope as well as other smaller amateur telescopes of reflective and refractive types.[140]
- *Planetarium of the Geographic Organization* is associated with the Ministry of Defense and Armed Forces Logistics (MODAFL).

3.14 The Zafaraniieh Observatory of Tehran is affiliated with the Institute for the Intellectual Development of Children and Young Adults of Iran, and it is equipped with a 10in Meade telescope as well as other smaller amateur telescopes of reflective and refractive types. [Institute for the Intellectual Development of Children and Young Adults of Iran]

- *Tehran Center for Science and Astronomy*, known as the *Niavaran Observatory*, is affiliated with the Municipality of Tehran.
- *Iranian National Observatory* is being constructed in Kashan and it will possess a reflective telescope with a diameter of 3.4m.
- *Isfahan Kowsar Observatory*.
- *Isfahan University Observatory*.
- *Observatory of the University of Mashhad*.
- *Alborz Observatory, Observatory of the High-Energy Cosmic Radiation*, Sharif University of Technology.
- *Ibn-e Salah al-Hamadani Observatory* in Hamadan.
- *Observatory of the Institute for Advanced Studies in Basic Sciences* of Zanjan.
- *Radio Observatory of the Institute for Advanced Studies in Basic Sciences* of Zanjan.
- *Observatory of the Azad University of Mahhallat*.
- *Mehr Observatory* of Bushehr.
- *Observatory and Planetarium of Alasht*, Mazandaran Province.
- *Observatory of the Iranian Space Agency* is located at the Alborz Space Center in Mahdasht, Karaj. It is equipped with a 16in Meade LX200 GPS telescope. A 1m reflective telescope will be added in the near future. It is the biggest observatory of the Alborz Province and one of the five greatest throughout the country.
- *Iran's Remote and Internet Observatory* is an Internet-based virtual observatory that enables interested astronomers to work individually and collectively and share their knowledge and findings. The site is available at http://www.universealive.com/.

3-1-4 Societies, associations and non-governmental organizations (NGOs)

In addition to the NGOs active in promoting astronomy, some of which were named above, there are active societies in the fields of aerospace and aviation. Some of these are listed below. But there are other societies and NGOs whose domains include remote sensing, GIS, GPS, space communications and relevant topics, in particular the Astronomical Society of Iran,[141] the Iranian Society of Remote Sensing and Geographical Information Systems, and the Iranian Society of Surveying Engineering and Geomatics.

Iranian Aerospace Society
The Iranian Aerospace Society is an association that is active in the scientific, research and technical domains of aerospace and is active in aerospace engineering, maintenance and operational issues, as well as law, aviation, and the peaceful use of astronautics.

Scientific Society of Air Transportation
Attended by a group of professors, administrators, scholars and experts in the aviation industry, this society was approved by the Ministry of Science, Research and Technology and officially started its activities in March 2009.

Iranian Society of Combustion
The Iranian Society of Combustion is a scientific, cultural, non-political and non-commercial group that was officially licensed in March 2000 by the Commission of the Scientific Associations of the Ministry of Science, Research and Technology.

Scientific Association of the Faculty of Aerospace Engineering of the Amir-Kabir University of Technology
This was formed 1996 as a Flying Club to operate in line with the scientific aims of the Faculty of Aerospace Engineering of the Amir-Kabir University of Technology. The club subsequently became the main pillar of the Scientific Association.

3-2 PUBLIC AWARENESS

Awareness and capacity building in the space domain at a public level has also been a major concern for Iran, with a lot of work being done by the state-run and private sectors. Celebrating World Space Week (WSW) is now a fruitful promotional program for ISA in cooperation with relevant bodies and organizations. WSW is well received by the public, particularly young people. Some universities are also developing plans to organize contests and competitions to draw the attention and participation of youths and university students to fields such as aerospace, rocketry and projectiles, distance control and robotics. Iran also publicly celebrates global events such as the International Year of Astronomy-2009 (IYA-2009).

3-2-1 Media and publications

Periodicals are the traditional means for public awareness, and a number are published in Iran about aerospace, aviation, geospatial science, and technologies such as remote sensing and geographical information systems, each by the appropriate organization and mostly in the Persian language. Some are publicly available and others are offered privately. Some have ceased publication. In recent years a specialized news agency has been introduced for aerospace. Known as AVIA, it has the web address of avia.ir, and is essentially the first Iranian Aerospace News Agency. Its main sponsor is the Raha Institute.[142]

The publications that are announced as research and scientific publications by the Ministry of Science, Research and Technology are:

- *Journal of Space and Earth Physics* is a scientific and research quarterly published by the University of Tehran.[143]
- *Journal of Space Science and Technology* is a scientific and research quarterly published by the Iranian Aerospace Society and the Aerospace Research Institute.[144]
- *Journal of Aerospace Science and Technology* is a scientific and research bi-quarterly published by the Iranian Aerospace Society.[145]
- *The Scientific Journal of Mechanics and Aerospace* is a scientific and research quarterly on mechanics and aerospace published by the Imam Hussein University of Iran.[146]
- *Journal of Aviation Engineering* is a scientific and research bi-quarterly published by the Shahid Sattari University of Science and Technology.[147]
- *Remote Sensing and GIS in Iran* is a scientific and research quarterly published by the Iranian Society of Remote Sensing.[148]
- *Surveying Science and Technology* is a scientific and research bi-quarterly published by the Iranian Society of Surveying Engineering and Geomatics.[149]

- *Survey Engineering and Spatial Information* is a scientific and research quarterly published by the Iranian Society of Surveying Engineering and Geomatics.[150]
- *Nivar* is a scientific and research bi-quarterly published by the IR Iran Meteorological Organization.[151]

In addition, departments of the universities of research organizations publish a handful of journals and periodicals on a variety of the topics relevant to space science and technology and its applications. Other promotional and scientific publications are also issued, some publicly and others with a limited circulation, including:

- *Peyk-e Hava-Faza* (Aerospace Currier) is a quarterly on aerospace engineering published by the Aerospace Engineering Department of the Amir-Kabir University of Technology.
- *Nojum* (Astronomy) is a monthly promotional scientific, news magazine on astronomy and space observations published by the Astronomical Society of Iran.[152,153]
- *Sanaye-e Hava-Faza* (Aerospace Industries) is a monthly scientific, news and analytic journal on aerospace industries published by the Aerospace Industries Organization.
- *Sanaye-e Havaie* (Aviation Industries) is a monthly journal on the aviation industry published by the Iran Aviation Industries Organization which is affiliated with Ministry of Defense and Armed Forces Logistics (MODAFL).
- *Sepehr* (Heaven) is a quarterly on survey engineering, remote sensing and geographical sciences published by the National Geographic Organization of Iran.
- *Pahbadha va Ayandeh* (UAVs and the Future) is a monthly journal published by Ghods Aerial Industries about Unmanned Aviation Vehicles (UAV). Commonly known as a drone, a UAV is an aircraft without a human pilot on board. Its flight is controlled either autonomously by onboard computers or under remote control by a pilot on the ground or in another vehicle.
- *IRSC Newsletter* is a bilingual periodical published monthly by the Iranian Remote Sensing Center as a means of continuing the magazine *Faza* after its publication by the Iranian Space Agency ceased. Despite the limited publication, the *IRSC Newsletter* was well received by its subscribers in the country and abroad until it also ceased publication.
- *Faza* (Space) was a monthly scientific and promotional magazine published by the Iranian Space Agency. Its publication ceased several years ago.
- *Parvaz* (Flight) is a monthly journal published by Ali Akbar Kovkab-zadeh about aircraft and pilotage.

3-2-2 Symposia, conferences and seminars

In Iran, a considerable number of symposia, conferences and seminars are held annually in relation to space sciences and related technologies, including aeronautics, astronautics, astronomy, space physics and geophysics, remote sensing, geographic information systems, space surveying, geomatics, tele-education, tele-health, etc. This is a reflection of the attention of the aerospace and space technology applications community at all levels, including managers, technocrats and scholars. The themes of the symposia cover

technology applications, space science and observations, and legal and social aspects of space and its technologies. A list of the most recent symposia about the aerospace, aeronautics and astronautics held in Iran is indicative of the status of space and space-related science and technologies in the country.

- The First Conference of the Iran Aerospace propulsion Engineering Association was held at the Isfahan University of Technology in 2012.[154]
- The Twelfth Conference of Iranian Aerospace Society was held at the Amir Kabir University of Technology in 2012.
- The First Conference on Satellites for Sustainable Development was held at the Amir Kabir University of Technology in 2012.
- The First National Conference on Aerodynamics and Hydrodynamics was held by the Sharif University of Technology and the Aviation Industries Organization in 2012.
- The Eleventh Conference of the Iranian Aerospace Society was held at the Shahid Sattari Aviation Science and Technology University in 2012.
- The Fourth Conference on Fuel and Combustion of Iran was held at the University of Kashan in 2012.
- The First Conference on the Estimation and Life Extension of Fatigued Air Structures was held at the Sharif University of Technology in 2011.
- The Second Conference on Reliability Engineering was held at the Aerospace Research Institute (ARI) in 2011.
- The First National Conference of Avionics was held at the Tarbiat Modarres University in 2011.
- The First Conference on Satellite Launchers was held at the Khajeh Nasir-e Tusi University of Technology in 2011.
- The Tenth International Conference on Aerospace was held at the Tarbiat Modarres University in 2011.
- The Tenth Conference of the Iranian Aerospace Society was held at the Tarbiat Modarres University in 2011.
- The Thirteenth Annual Conference and the Second International Conference on Fluid Dynamics was held at Shiraz University in 2010.
- The First Scientific Conference of Aerospace Engineering was held at the Amir Kabir University of Technology in 2010.
- A Conference of the Employment Status of the Aerospace Graduates was hosted by the Office of the President for Aerospace Cooperation in 2010.
- The Ninth Conference of the Iranian Aerospace Society was held at the Science and Research Branch of the Islamic Azad University in 2010.
- The Third Conference of Fuel and Combustion of Iran was held at the Amir Kabir University of Technology by the Combustion Society of Iran in 2009.

3-2-3 International or national occasions and World Space Week

Collective activities, including competitions and contests on space science and technology are highly considered by the authorities of the academic and governmental sector because they draw the interest of different social groups, particularly the young, to space technology and the manner in which it can benefit mankind at the national and global levels.

Competitions of school and university students

A number of contests, competitions and festivals are organized and held in Iran annually to promote and familiarize the public and technically educated community of Iran with recent advancements in aerospace topics. A list illustrating the variety of competitions and contests is given below. It focuses on encouraging talented youngsters to pursue topics in the domains of space science and technology for their higher education and future careers.

- *Aerospace Student Competition.* This was initiated in 2007 by the Aerospace Department of the Amir Kabir University of Technology. It is an annual event which is open to high school and university students across Iran and has a number of categories, including the design and manufacture of macaroni gliders, balloons equipped with GPS, vertically flying water rockets equipped with parachutes, micro-jet engines, and hovercraft. The competition is well received by the students, indicating the eagerness of teenagers to work in the aerospace field.[155]
- *Aerospace System Design Competition.* In 2010 the Center for Excellence in Aerospace Systems (CEAS) of the Sharif University of Technology introduced the

3.15 High school students competing with vertically flying water rockets equipped with parachutes at the Third Aerospace Student Competition held at the Amir Kabir University of Technology on April 24, 2009. The Aerospace Student Competition has been held annually since 2007 in Iran, and is open to high school and university students throughout the country. [Shahryar Tarikhi]

Aerospace System Design Competition. It is an annual event for high school and university students across the country, with categories including the design and manufacture of balloons, gliders, hovercraft, rockets with retrievable payloads, and vertically flying rockets. It focuses on enhancing and persuading the participants to go on to make a contribution to the design and manufacture of aerospace systems.[156]

- *Iran Can-Sat Competition.* Can-Sat is an aerospace system that is used for educational and research purposes. It is made up of two words, 'Can' referring to a soda can and 'Sat' as the short form of the word 'satellite'. Can-Sat is indeed an easily producible tiny satellite that is released and retrieved from an altitude of 100m by parachute, which is a sufficient distance for the payload to perform its task. Given the potential for this type of projectile, starting in 2011 the Astronautics Research Institute (formerly the Aerospace Research Institute-ARI) affiliated to the Iranian Space Agency launched the annual Iran Can-Sat Competition (ICC) which accommodates the competitors' interest and students' enthusiasm for participating in a competition which involves design, development and operation.[157]
- *Design of Flying Objects Competition.* This annual competition has categories at a number of levels for high school and university students. It was initiated in 2011 by the Sharif University of Technology in cooperation with the Aviation Industries Organization and the Office for Aerospace Technology Development affiliated with the state Presidential Institution. It seeks to enhance the enthusiasm of the participants in the design and manufacture of flying objects, including drones.[158]

In addition, some new competitions are planned to be held annually by the Malek Ashtar Technical University, including:

- *Annual Innovations Competition: Manned Flight to Sub-orbital Altitude* was hosted by the Malek Ashtar Technical University for the first time in 2012.
- *Annual Competition on Student UAVs in North West of Iran* was held by the Malek Ashtar Technical University and hosted by the Urmieh University of Technology for the first time in 2013.

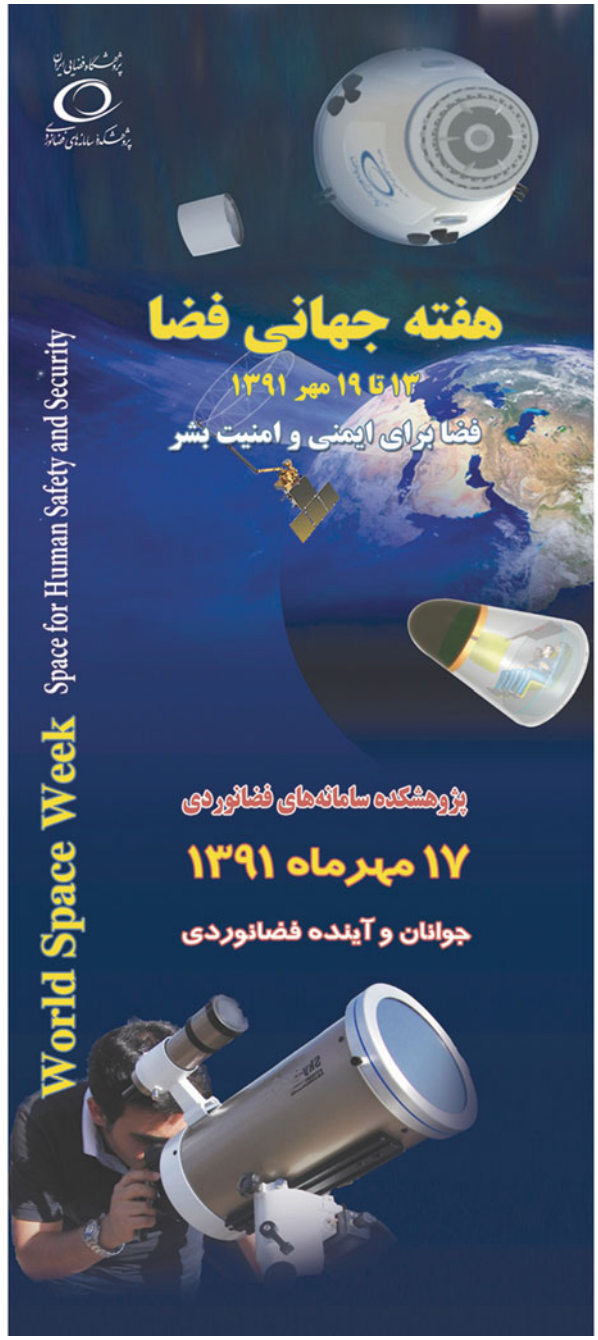
World Space Week

World Space Week is the largest annual space event in the world and it is held from October 4-10 in almost all of the continents of the world. Recommended by the United Nations Third International Conference on the Exploration and Peaceful Uses of Outer Space, World Space Week was officially declared in 1999 by the United Nations General Assembly as 'a yearly celebration at the international level of the contribution that space science and technology can make to the betterment of the human condition.' This was done in response to the unanimous recommendation of the nations represented at UNISPACE-III as included in the Vienna Declaration. The objective is to increase awareness among decision-makers and the public at large about the benefits of the peaceful uses of space. This week of activities inspires young people all over the world by making them aware of the importance of space science, technology and applications in everyday life, and in helping to address some of today's most urgent problems. Coupled with

3.16 The logo of the World Space Week which occurs October 4-10 each year. [WSW Organization]

advances made in other fields of science and technology, they offer a wide range of specific tools and solutions that are transforming weather forecasting, environmental protection, humanitarian assistance, disaster management and more. The choice of dates was based on recognition of two important dates in space history, namely the launch of Sputnik as the first satellite on October 4, 1957 and the signing of the Outer Space Treaty on October 10, 1967.

Since the United Nations General Assembly declared World Space Week in 1999 it has become a worldwide celebration of how science and technology contributes to the improvement of the human quality of life and welfare. The United Nations Office for Outer Space Affairs (UNOOSA), with its partners, has been working to bring the benefits of space to Earth, to make the seemingly remote and abstract realm of outer space of direct relevance to people worldwide and World Space Week, under the guidance of UNOOSA, is an ideal opportunity. Iran has always been an enthusiastic contributor by organizing conferences, technical and specialized thematic seminars on topics related to space science and technology application, interviews, contests for youths and adults, competitions, festivals, posters, brochures, books and pamphlets, and using the national media to show the importance and vitality of space technology applications in the improvement and advancement of the community.



3.17 A poster published by the Astronautical Systems Research Institute of the Iranian Space Agency for World Space Week in 2012. [ARI]

3-3 STATUS OF HUMAN RESOURCES IN SPACE AND AEROSPACE CAREERS

In the past two decades, Iran has worked on basic capacity building in space science and technology by developing education and training at graduate and postgraduate levels. Around 14 universities and research and development institutions in the field of aerospace are currently active at undergraduate and master's degree levels, and one aerospace research institute provides education at the doctoral level. The subjects include aerospace technology, remote sensing, satellite telecommunications, and global positioning systems.[159] Aerospace engineering, which is considered to be one of the important careers in the country, was first established in 1984 at the Amir-Kabir University of Technology. It is now also available at bachelor's level by the Khajeh Nasir-e Tusi Technical University, the Sharif Technical University, the Imam Hussein University, the Shahid Sattari University, the Malek Ashtar Technical University, and the Science and Research Branch of the Azad University, all of which are situated in Tehran. The Tarbiat Modarres University, the Elm-o-Sanat University of Iran (the Iran University of Science and Technology), the Mashhad Ferdowsi University, Shiraz University, the Shahid Beheshti University, and the Aerospace Research Institute (ARI) offer aerospace courses at master's level in addition to bachelor's level. In some of the top universities of Iran, including the Amir-Kabir University of Technology, aerospace courses are also available at doctoral level.

3-3-1 Employment status of the space science and technology and aerospace graduates

The most appropriate employment environments for graduates of space science, space physics and astronomy are the universities and other research institutions involved with relevant subjects, but the industrial sector also benefits. The field is a bit wider for graduates of aerospace engineering. It is the same for graduates of disciplines related to space technology applications such as remote sensing and GIS, and also for communications. They are sought by the national defense industry, civil industrial sector and the private sector. Aerospace engineering graduates are usually employed by the national defense industry (24%), the non-defense government sector (18%), and the private sector (27%, of which roughly half obtain jobs in aerospace and the rest are in non-aerospace private enterprises). Of the remainder, 10% leave the country to pursue graduate studies or to seek employment and the others either attend graduate schools or have yet to find employment. Hence almost half of the graduates in aerospace fields are employed by the government.[160]

3-3-2 Educational attainment of space science and technology and aerospace workers

Studies at graduate and post-graduate levels are a prerequisite to working in aerospace and the various different fields of space science and technology and its applications. Such workers are able engineers and scientists. For instance, 82% of the aerospace employees bear either master's or doctoral degrees. This figure refers to those who are employed by the domestic aerospace industry. This high level of educational achievement is an indication of the interest of students in taking advanced studies and the motivation of instructors for research and development. Moreover, the statistics indicate availability of ample educational opportunities in this field in Iran.[161]

4

International cooperation: a progressive approach

The start of the Space Age for Iran was a promising opportunity that saw the country participate in the establishment by the United Nations of the Committee on Peaceful Uses of Outer Space (COPUOS). This was useful for Iran not only in terms of its international policy and prestige, but also because the experience enhanced its national policy and benefitted it in subsequent years.

After contributing to establish the United Nations ad-hoc Committee for International Cooperation on Space in 1958, a further logical step for Iran was to sign or ratify various United Nations treaties on outer space. In addition to the treaties on space, Iran became a party to other international agreements relating to outer space, namely the Treaty on Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water (known as the Nuclear Test Ban Treaty); the Agreement Relating to the International Telecommunications Satellite Organization (ITSO); the Convention on the International Mobile Satellite Organization (IMSO); and the Constitution and Convention of the International Telecommunication Union (ITU).

By creating the Iranian Space Agency, Iran gave the highest priority to international cooperation in line with the country's policy for seeking international interaction in space applications and exploiting all practical opportunities in this regard. Given this goal, ISA has made cooperating in UN-COPUOS its primary function. Its representative contributed to the COPUOS Bureau as Second Vice Chairman and Rapporteur from 2004 to 2006. And Iran's contribution to the Recommendations of the Third UN International Conference on Exploration and Peaceful Uses of Outer Space (UNISPACE-III) included chairing the Action Team for the Development of a Worldwide Comprehensive Strategy for Environmental Monitoring, a program that started in 2001, and participating in the establishment of a UN Space-based Platform for Disaster Management (SPIDER). In addition, Iranian delegations have been involved in various space-related issues from technical and scientific concerns to legal aspects, providing a strong indication of the country's interest in actively working in the global arena to use space peacefully. ISA has organized and hosted workshops and seminars related to space science and technology applications, with special emphasis on remote sensing, and disaster monitoring and mitigation in cooperation with UNOOSA, the Inter-Islamic Network on Space Technology (ISNET) and appropriate global and regional entities. And in recent years Iran has devoted special

P. Tarikhi, *The Iranian Space Endeavor: Ambitions and Reality*, Springer Praxis Books,
DOI 10.1007/978-3-319-05347-9_4, © Springer International Publishing Switzerland 2015

priority to the legal aspects of space applications, chairing the Legal Subcommittee of COPUOS for the period of 2010-2011.

At the regional level, Iran cooperates with the UN Economic and Social Commission of Asia and the Pacific (ESCAP) and follows the plans and efforts by its Regional Program on Space Technology Applications (RESAP). Iran and ESCAP have worked closely to establish a Centre for Informed Space-based Disaster Management and an affiliated research center in recent years. On the initiative of the Asia-Pacific Multilateral Cooperation on Space Technology Applications (AP-MCSTA) Iran cooperated in manufacturing a small multi-mission satellite for disaster management. Iran joined the Convention of the Asia-Pacific Space Cooperation Organization (APSCO) under AP-MCSTA on October 28, 2005 as one of its founders and signatories, along with China, Indonesia, Pakistan, Thailand, Bangladesh, Mongolia, Peru and Turkey. This was an important step in opening a new era in space cooperative activities. APSCO was established in January 2010 and Iran's contribution has been of considerable help to the nation in its peaceful use of space science and technology. Another entity to which Iran belongs is the Committee on Space Research (COSPAR) of the International Council of Scientific Unions (ICSU, now the International Council for Science), which organized its first Space Science Symposium in 1960. Iran's membership of the International Society of Photogrammetry and Remote Sensing (ISPRS), the Asian Association on Remote Sensing (AARS), and the Asia-Pacific Satellite Communications Council (APSCC) are all further indications of the country's desire to participate in international programs in space applications and science. It is therefore highly significant that almost all of Iran's endeavors in implementing satellite projects such as Mesbah, Zohreh, SMMS and Sina-1 were the result of international cooperation, as were the creation of the Mahdasht Satellite Receiving Station (MSRS) and other space-related ground stations and facilities.

4-1 WELCOMING THE SPACE AGE, THE PAST THAT HERALDED A PROMISING FUTURE

Iran welcomed the Space Age by contributing to the creation of COPUOS. Iran's active participation in COPUOS and its legal, and scientific and technical subcommittees in the course of the first decade of the Committee is well documented.[162] In the diplomatic and legal domain, it was Mehdi Vakil, the Ambassador Extraordinary and Plenipotentiary Permanent Representative to the United Nations in New York, and his colleagues from the Iranian Mission to the UN in New York and other delegation members from the Ministry of Foreign Affairs who participated in COPUOS and the meetings of its Legal Subcommittee, a tradition that continues to this day. Born in 1897, Mehdi Vakil studied for a PhD in law and political science in France.[163] Records show that Iran was involved in international space decisions in the early days, but it does not offer much insight into Iran's space developments. They further indicate that, in addition to Mehdi Vakil, other delegation members in the years 1963 to 1970 included Houshang Amirmokri, who was Second Secretary of the Permanent Mission of Iran, Hassan Zahedi, Mohieddin Nabavi, Moshen Esfandyari, and Farrokh Parsi. In March 1969, Mehdi Vakil was still the Iranian Representative to the UN General Assembly and also represented Iran in COPUOS.

62 FLIGHT International, 11 January 1962

Missiles and Spaceflight . . .

first OGO spacecraft, which will be launched from Cape Canaveral by Atlas Agena B during 1963 into a highly eccentric orbit having a 170-mile perigee and 70,000-mile apogee. This particular OGO has been named EGO (the letter E standing for eccentric), while a low-altitude (300-1,000 miles) polar-orbit mission which is scheduled approximately one year later for another OGO craft is designated POGO. These two orbits are the basic trajectories envisaged for the geophysical observatory.

The weight of the 19 experiments chosen for EGO will be approximately 150lb. They will be distributed throughout the spacecraft, with some experiments having components in more than one location in the satellite. Components of 15 experiments, weighing more than 87lb, are located in standard-size boxes in the main body of the satellite (see centre diagram on p. 61). Components of five experiments are carried in packages at the end of the two solar paddles; these weigh about 17lb.

Experiments weighing 14lb are contained in three 5lb booms, and a fourth short boom is available to provide for changes of location of experiments that may prove necessary as a result of pre-flight tests. Almost 100lb of experiments are contained in two 20lb booms. Five experiments weighing 20lb are located in the two orbit plane experiment packages.

"Stretch" in the OGO design allows for an increase to 250lb for scientific experiments and to 1,300lb for total spacecraft weight; and the addition if necessary of a 300lb piggyback satellite.

At present, [illegible] developed for NA[illegible] Angeles at the [illegible] Purt, Redondo [illegible] the OGO satel[illegible] permitting orb[illegible] materials and [illegible]

UN Agreement on Space

from James Avery Joyce

United Nations, New York

LAST month's UN resolution on international co-operation in the peaceful uses of outer space, as detailed in last week's issue, lays down two basic principles—that international law applies to outer space; and that celestial bodies are not subject to national appropriation. Views expressed in the main political and security committee by delegates from the USA, USSR, Canada and Britain were reported last week, and those of other delegates are quoted below. The resolution was adopted unanimously by the General Assembly on December 20.

Dr **Jose Carlos Ferreira** of Argentina, said his Government would not countenance the absence of law in outer space. Problems involving "countries below" and "celestial bodies above" could be solved only on an international basis. He particularly noted that USSR jurists had agreed on the point that sovereignty over the space "above" a nation was no longer either real or possible. **Mr James Plimsoll**, Australian delegate, declared that the UN must set a framework for international co-operation in outer space; otherwise, bilateral and exclusive multilateral agreements would be made. Similarly, the Italian spokesman, **Gaetano Martino**, said that outer space belonged to everyone, but the equal rights of all States in outer space could be protected only within the framework of the United Nations. He recommended that certain fields—space meteorology, space communications, space traffic-control and space law—be given prior attention by the new outer-space committee.

Perhaps the most philosophical approach was presented by that veteran international lawyer, Dr **Victor Andres Belaunde**, who has for so many years served the UN Assembly as the representative of Peru. He stated that international law should unquestionably apply to outer space. Sovereignty could only apply to airspace—i.e., where aircraft and balloons were capable of flying. Outer space could not be subject to national claims; the "power struggle" should not be extended there. The benefits of outer space, in such matters as weather control, must be safeguarded by full international control. The United Nations must develop into an international community rather than remain merely a "debating society" and a clearing house for the indexing of treaties.

From the United Arab Republic, **Omar Loufti** insisted that outer space should never be a field for the arms race. From Poland, **Jacek Machowski** said that the outer-space committee should reflect the "three main groups" in the world, and must accept the principle of the sovereign equality of States. He argued that this emphasis was consistent with the fact that international law and the United Nations Charter applied to outer space.

It was to be observed that members of the "unaligned" group gave equal honours to the US and Soviet space exploits. Only the briefest summary of further viewpoints can now be given. **Katsoo Okazaki** (Japan) emphasized the need for reaching agreement on the banning of the use of outer space for military purposes, and hoped that me[illegible] efforts to achie[illegible] **Raymond Sche[illegible]** questions invol[illegible] made.

Mrs Agda R[illegible] voting procedu[illegible] tained that there [illegible] agreement betw[illegible] welcome a deci[illegible] **Tanas Lorinc,** if the United St[illegible] get nowhere w[illegible] exploration. H[illegible] sensed that, alt[illegible] peaceful uses of [illegible] making the Mo[illegible] for the paralys[illegible] alleged, because [illegible] committee woul[illegible] between the US

Coming to t[illegible] of Spain said t[illegible] juridical princi[illegible] India wanted more than that, and **Chandra S. Jha** urged the Great Powers to make a *declaration*, without awaiting agreement on disarmament, that outer space would never be used for military purposes. **Zenon Rossides,** of Cyprus, similarly urged that it was essential to agree that man's petty differences on earth should not be carried into outer space.

Dr Mehdi Vakil, of Iran, in a thoughtful contribution, asked whether the vast area of outer space was to be regulated by law for the benefit of mankind, or be left to develop in a haphazard way and thereby become another source of contention between nations? Happily, neither the USA nor the USSR had claimed a privileged position; and the lack of objection by any State to the free orbiting of satellites seemed to be a tacit acknowledgement that territorial sovereignty did not extend beyond any State's own air-space. These developments pointed towards the rule of *res communis omnium* in outer space.

Certain analogies might be drawn from the law of the sea, air and Polar regions, the speaker indicated, as a general pattern for action; but it would be a mistake to push them too far in their technicalities. Although the development of a legal code for outer space would be hampered if detailed laws were formulated at such an early stage, the United Nations should not be deterred from determining those that were more general for early codification. Past experience should alert the UN to the difficulties resulting from delay in establishing such a code of law.

4.1 A page from the *Flight International* magazine dated January 11, 1962 reporting the statements of Iran's representative, Mehdi Vakil to the meeting of the United Nations Committee on Peaceful Uses of Outer Space. He believed that *res communis omnium* should apply in outer space. [*Flight International Magazine*]

In 1971 he was substituted by Fereydoun Hoveyda.[164] After leaving his position as Iran's Ambassador to the United Nations in New York, Vakil was appointed as Ambassador of Iran to the Vatican.[165]

However, it was reportedly Mahmoud Hessabi (1903-1992) who represented Iran on the country's delegation to the Scientific and Technical Subcommittee of UN-COPUOS during the years 1961 to 1968.[166,167] The activity of the Scientific and Technical Subcommittee was actually initiated in 1962 and, as a result, Dr. Hessabi was the first Iranian delegation member of the Scientific and Technical Subcommittee. Hessabi was a prominent and distinguished Iranian scientist, researcher and professor at the University of Tehran. He was a polymath who studied different fields including space science and technology, and it was this that made him ideal to represent Iran on the Scientific and Technical Subcommittee of COPUOS. In addition to founding the Telecommunication Center of Asad-Abad in Hamadan, his further achievements about space and related technologies include establishing the first modern observatory of Iran in 1945, establishing the satellite tracking center of Iran in 1957, both in Shiraz, and founding and heading the Geophysical Institute of the University of Tehran from 1951 to 1965. Moreover, he

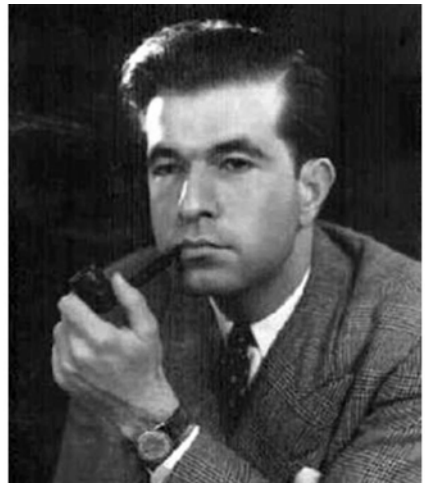
4.2 Paul Creston and Mehdi Vakil (right), the Iranian representative to UN-COPUOS in the early decade of the committee. Paul Creston (1906-1985) was an Italian American composer of classical music. Born in New York City to Sicilian immigrants, he was a self-taught composer. [University of Missouri-Kansas City, Paul Creston Collection]

reportedly initiated the membership of Iran in the Committee on Space Research (COSPAR) and represented Iran at UNISPACE-82 (United Nations Second International Conference on the Exploration and Peaceful Uses of Outer Space in 1982).[168] He was fully deserving of the honor of representing Iran at COPUOS and its Scientific and Technical Subcommittee, in addition to other space-related panels and deliberations domestically and internationally.

A decade after the start of the Space Age, a new era in terms of Iran's contribution to COPUOS emerged. The mission of Mehdi Vakil ended in 1971 when he was replaced by Fereydoun Hoveyda (1924-2006) as Ambassador Extraordinary and Plenipotentiary Permanent Representative of Iran to the United Nations. The brother of Amir Abbas Hoveyda, a former prime minister of Iran under the Shah Mohammad Reza Pahlavi, Fereydoun Hoveyda was an influential diplomat, writer and thinker. He obtained a PhD degree in international law and economics from the Sorbonne in Paris in 1949. As a participant in the final drafting of the Universal Declaration of Human Rights, he worked with UNESCO from 1951 to 1966. He served at the United Nations and was the Iranian representative in COPUOS until the revolution in Iran in 1979.[169]

During the period 1971 to 1979 the contribution of Iran to the UN, and hence to COPUOS, was considerably influenced by Ashraf Pahlavi (b.1919), the twin sister of Mohammad Reza Pahlavi, the late Shah of Iran. Princess Ashraf was enthusiastically

4.3 Mahmoud Hessabi (1903-1992) was a prominent Iranian polymath who was Iran's delegate to the Scientific and Technical Subcommittee of UN-COPUOS from 1962 to 1968. [Professor Hessabi Foundation]



4.4 Fereydoun Hoveyda (1924-2006) headed Iran's delegations to COPUOS from 1971 to 1979. An influential diplomat, writer and thinker, he was a participant in the final drafting of the Universal Declaration of Human Rights. [Radio Zamaneh]

Table 4.1. The different phases of Iran's contribution to COPUOS since its establishment. [Author].

Title of the Era	*Period*	*Achievements*	*Effective contributors and players*
Active constructive contribution	1958 to ~1970	– Signing and ratifying UN Treaties on Outer Space – Ratifying NTBT	Mehdi Vakil Mahmoud Hessabi
Aristocracy	1971 to 1979	– Signing and ratifying UN Treaties on Outer Space – Ratifying ITSO and IMSO	Fereydoun Hoveyda
Refusal and suspension	1979 to ~1987		
Pragmatism	~1987 to 1997	– Ratifying ITU Convention	Farshid Jahedi
Bewilderment	1997 to 2000		
Reformation	2000 to 2006	– COPUOS Bureau member (2003-2006) – Chairing Action Team #1 of the UNISPACE-III Recommendations (2001-2007) – Improving cooperation with COPUOS – Contribution to Space Law	Pirouz Husseini Parviz Tarikhi Hassan Shafti
Dilemma of Mistrust and Restoration	2006 to date	– Disputed chairing of the Legal COPUOS (2010-2011) – Contribution to Space Law	Ahmad Talebzadeh Hassan Shafti

interested and active in the United Nations and other international efforts.[170] After the onset of the revolution in Iran, which achieved victory early in 1979, the participation of Iran in COPUOS and other international entities was suspended for several years. Although Iran later attended COPUOS meetings on an occasional basis it was only in 2000 that during the course of internal reforms Iran attempted to contribute to COPUOS and other international forums regularly and continuously (as will be discussed later in this chapter).

4-2 IRAN'S CONTRIBUTION TO SPACE LAW

After joining 17 other countries to establish the United Nations ad-hoc Committee for International Cooperation on Space in 1958, the important step for Iran regarding space law was to sign the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty) in 1967. Iran ratified both the Treaty on the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue Agreement) and the Convention on International Liability for Damage Caused by Space Objects (Liability Convention) that came into force in 1968 and 1972,

Table 4.2. Iran's status with respect to the UN Treaties related to Outer Space. [OOSA].

Title of the treaty	*Detail*	*Iran's status*
The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies	The "Outer Space Treaty", adopted by the General Assembly in its Resolution 2222 (XXI) Opened for signature: 27 January 1967 Entry into force: 10 October 1967 98 ratifications and 27 signatures (as of 1 January 2008) [http://www.unoosa.org/oosa/en/SpaceLaw/outerspt.html]	**Signatory**
The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space	The "Rescue Agreement", adopted by the General Assembly in its Resolution 2345 (XXII) Opened for signature: 22 April 1968 Entry into force: 3 December 1968 90 ratifications, 24 signatures, and 1 acceptance of rights and obligations (as of 1 January 2008) [http://www.unoosa.org/oosa/en/SpaceLaw/rescue.html]	**Ratified**
The Convention on International Liability for Damage Caused by Space Objects	The "Liability Convention", adopted by the General Assembly in its Resolution 2777 (XXVI) Opened for signature: 29 March 1972 Entry into force: 1 September 1972 86 ratifications, 24 signatures, and 3 acceptances of rights and obligations (as of 1 January 2008) [http://www.unoosa.org/oosa/en/SpaceLaw/liability.html]	**Ratified**
The Convention on Registration of Objects Launched into Outer Space	The "Registration Convention", adopted by the General Assembly in its Resolution 3235 (XXIX) Opened for signature: 14 January 1975 Entry into force: 15 September 1976 51 ratifications, 4 signatures, and 2 acceptances of rights and obligations (as of 1 January 2008) [http://www.unoosa.org/oosa/en/SORegister/regist.html]	**Signatory**
The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies	The "Moon Agreement", adopted by the General Assembly in its Resolution 34/68 Opened for signature: 18 December 1979 Entry into force: 11 July 1984 13 ratifications and 4 signatures (as of 1 January 2008) [http://www.unoosa.org/oosa/en/SpaceLaw/moon.html]	**Non-Party**

respectively. It also signed the Convention on the Registration of Objects Launched into Outer Space (Registration Convention), which became effective in 1976. The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement) is the only one of the five UN treaties about outer space to which Iran is not yet a party.[171]

In addition, Iran is party to other international agreements relating to activities in outer space. It has ratified the Treaty on Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water (Nuclear Test Ban Treaty, NTBT) which became effective in 1963, the Agreement Relating to the International Telecommunications Satellite Organization (ITSO) that entered into force in 1973, the Convention on the International Mobile Satellite Organization (IMSO) which began in 1979, and the International Telecommunication Union's Constitution and Convention that entered into force in 1994. Iran has a non-Party position for other UN Declarations and Legal Principles, as well as other Principles and International Agreements.[172]

Concerning the United Nations Treaties related to Outer Space, the status of Iran is the same as before the revolution of 1979 from the international legality point of view and there have been no changes. Iran holds the non-Party position for UN declarations and legal principles related to Outer Space. These principles includes, the Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space, the Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, the Principles Relating to Remote Sensing of the Earth from Outer Space, the Principles Relevant to the Use of Nuclear Power Sources in Outer Space and the Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries. Only the Declaration of Legal Principles Governing

Table 4.3. Iran's status with respect to UN Declarations and Legal Principles related to Outer Space. [OOSA].

Title	*Detail*	*Iran's status*
The Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space	General Assembly Resolution 1962 (XVIII) of 13 December 1963	**Non-Party**
The Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting	Resolution 37/92 of 10 December 1982	**Non-Party**
The Principles Relating to Remote Sensing of the Earth from Outer Space	Resolution 41/65 of 3 December 1986	**Non-Party**
The Principles Relevant to the Use of Nuclear Power Sources in Outer Space	Resolution 47/68 of 14 December 1992	**Non-Party**
The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries	Resolution 51/122 of 13 December 1996	**Non-Party**

Table 4.4. Iran's status with respect to Principles and International Agreements related to Outer Space. [OOSA].

Title	*Detail*	*Iran's status*
The Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water (NTB)	Opened for signature: 5 August **1963** in Moscow Entry into force: 10 October 1963 Depositaries: USSR, UK and USA	**Ratified**
Agreement Relating to the International Telecommunications Satellite Organization (ITSO)	Opened for signature: 20 August **1971** in Washington, D.C. Entry into force: 12 February 1973 Depositary: USA	**Ratified**
Agreement on the Establishment of the INTERSPUTNIK International System and Organization of Space Communications (INTR)	Opened for signature: 15 November **1971** in Moscow Entry into force: 12 July 1972 Depositary: Russian Federation	**Non-Party**
Convention relating to the Distribution of Program-Carrying Signals transmitted by Satellite (BRS)	Opened for signature: 21 May **1974** in Brussels Entry into force: 25 August 1979 Depositary: Secretary-General of the UN	**Non-Party**
Convention for the Establishment of a European Space Agency (ESA)	Opened for signature: 30 May **1975** in Paris Entry into force: 30 October 1980 Depositary: France	**Non-Party**
Agreement of the Arab Corporation for Space Communications (ARABSAT)	Opened for signature: 14 April **1976** (14 Rabi' II 1396 H) in Cairo Entry into force: 16 July 1976 Depositary: League of Arab States	**Non-Party**
Agreement on Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes (INTERCOSMOS)	Opened for signature: 13 July **1976** in Moscow Entry into force: 25 March 1977 Depositary: Russian Federation	**Non-Party**
Convention of the International Mobile Satellite Organization (IMSO)	Opened for signature: 3 September **1976** in London Entry into force: 16 July 1979 Depositary: Secretary-General of the International Maritime Organization	**Ratified**
Convention Establishing the European Telecommunications Satellite Organization (EUTELSAT)	Opened for signature: 15 July **1982** in Paris Entry into force: 1 September 1985 Depositary: France	**Non-Party**
Convention for the Establishment of a European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)	Opened for signature: 24 May **1983** in Geneva Entry into force: 19 June 1986 Depositary: Switzerland	**Non-Party**
International Telecommunication Constitution and Convention (ITU)	Opened for signature: 22 December **1992** in Geneva Date of entry into force: 1 July 1994 Depositary: Secretary-General of the International Telecommunication Union and Convention	**Ratified**

the Activities of States in the Exploration and Uses of Outer Space belongs to the pre-revolution era in Iran, and the other four are outcomes of UN deliberations contemporaneous with the post-revolution era in Iran. Iran has been inactive and holds no position overall concerning the declarations and legal principles related to Outer Space issued by the United Nations.

Concerning the 11 Principles and International Agreements related to Outer Space, Iran has only ratified four cases: NTB, ITSO, IMSO and ITU. The position of Iran on the other seven is non-Party. Among the sets of the Principles and International Agreements related to Outer Space, only three have been issued by Iran in the post-revolution era, namely the Convention of Establishing the European Telecommunications Satellite Organization (EUTELSAT), the Convention for the Establishment of a European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), and the International Telecommunication Constitution and Convention (ITU).[173]

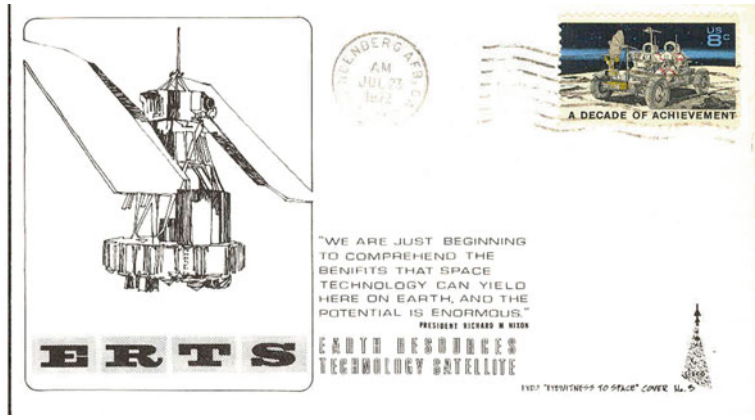
In recent years Iran has given special priority to the legal aspects of space applications, and in this connection it made a further contribution by taking the chair of the Legal Subcommittee of COPUOS in 2010-2011. Moreover, the Iranian Space Agency follows the core activity of conducting domestic symposia on space law. The United Nations and Iran held a joint Workshop on Space Law with the theme of the Role of International Space Law in the Development and Strengthening of International and Regional Cooperation in the Peaceful Exploration and Use of Outer Space, held on November 8-11, 2009 in Tehran, to discuss capacity building in space law and regulatory frameworks governing space activities, in particular for countries in Western Asia. This provided an overview of the legal regime governing the peaceful uses of outer space, examined and compared various aspects of existing national space legislation, and considered the current state of academic studies and programs in space law and methods of enhancing the availability and development of those studies and programs.[174] Its objectives included promotion of the understanding, acceptance and implementation of the UN treaties and principles on outer space; promotion of the exchange of information on national space legislation and policies for the benefit of professionals involved in national space activities; consideration of the trends and challenges in international space law, such as the commercialization of space activities and the increase in participants involved in space activities; consideration of the development of academic studies and programs in space law, with a view to promoting national expertise and capacity in this field; and consideration of the mechanisms for increasing regional cooperation in the peaceful uses of outer space. The countries attending were Argentina, Azerbaijan, Czech Republic, France, Germany, Greece, Iran, Iraq, Italy, Netherlands, Republic of Korea, Thailand, Turkey, Ukraine and the United States of America. Furthermore, the Asia-Pacific Space Cooperation Organization, the International Institute for the Unification of Private Law (UNIDROIT) and the Office for Outer Space Affairs were represented. In all, the workshop was attended by 185 legislators, government officials, practitioners and educators holding positions in government departments and representatives of space agencies, international organizations, national universities, research institutions and the private sector.[175]

4-3 MAHDASHT RECEIVING STATION AND THE IRANIAN REMOTE SENSING CENTER

In addition to making an active contribution to international cooperation for peaceful uses of space, Iran sought direct national and popular benefit from international cooperation. The first steps were the establishment of the Asad-Abad Ground Station and installation of the facilities for connecting to the Pacific Intelsat for international communications in 1969. Since then, space technology applications in Iran have expanded into telecommunications, television broadcasting, remote sensing, navigation, tele-education, weather forecasting, environmental modeling, Internet connectivity, and relief and rescue.

Shortly after the launch of the first Earth Resource Technology Satellite (ERTS, later Landsat-1) on July 23, 1972, Iran, with technical assistance from the USA, created the Mahdasht Satellite Receiving Station (MSRS) to collect, process, and distribute imagery products to users throughout the country for resource planning and management. Having access to remote sensing data greatly assisted in dealing with a variety of technical issues, including: identifying areas suitable for economic development and pinpointing areas prone to earthquakes, floods, landslides, and other natural disasters; investigating greenhouse gas emission and air pollution in the large urban areas; and monitoring wetlands and water basins inland and those shared with neighboring countries. At the time of its establishment the station was one of only five around the world capable of receiving Landsat data. Its establishment was Iran's first bilateral international cooperation in space technology.[176]

The MSRS was managed and controlled by the office in the Iranian Planning and Budget Organization that was then known as the Plan for Operating of the [remote sensing] Satellite but which later became the Iranian Remote Sensing Center (IRSC). This went on to become the central pillar of the Iranian Space Agency and, as a result, has played the key role in the Iranian space endeavor as an official and national entity. Because it came


E R T S
"WE ARE JUST BEGINNING TO COMPREHEND THE BENIFITS THAT SPACE TECHNOLOGY CAN YIELD HERE ON EARTH, AND THE POTENTIAL IS ENORMOUS."
PRESIDENT RICHARD M. NIXON
EARTH RESOURCES TECHNOLOGY SATELLITE
A DECADE OF ACHIEVEMENT
US 8c

4.5 A sketch of the first US Earth Resource Technology Satellite (ERTS) system on a postcard. The satellite was later renamed Landsat-1. [Colorado State University, USA]

about by international cooperation in space technology, the IRSC was the focal organization for space activities at both the national and international levels. It is notable that the establishment of the Iranian Space Agency was a turning point for the Iranian space endeavor, but not its starting point. On the other hand, if it is taken as the point of origin then it can be stated that the previous phase of the endeavor was more promising than the subsequent period and the reason for this can be found in the political, social and economic climates of the two eras. Prior to the Iranian Space Agency, the IRSC was the pivotal entity in Iran for its space endeavor. Establishing the space agency was a substantially positive and constructive effort to institutionalize the space activities in Iran under an administration that was mandated to concentrate, regulate, and properly conduct the space-related efforts nationwide. Consequently, it would be beneficial if the activities of the IRSC in this connection were taken into account. But it should also be noted that international cooperation has been the leaven and millstone for the Iranian space endeavor since the early days of the Space Age. In order to understand the development of the Iranian space endeavor, it is essential to recognize the role of the IRSC.

4-3-1 Establishment and operation of the Mahdasht Receiving Station

Satellite remote sensing data is recognized as an efficient and modern tool for studying and monitoring the environment and resources, and Iran has made use of it because such data has been made available commercially. The launch by the US of the Earth Resource Technology Satellite (Landsat-1) in 1972 further developed interest in satellite remote sensing and related space technologies. The intention to obtain remote sensing products originated with the Plan for Satellite Data Applications in the Iranian Planning and Budget Organization. After a feasibility study, Mahdasht (formerly Shahdasht) situated some 65km west of Tehran in Karaj was selected as the optimal place to establish a station for direct satellite data reception. As a result, the facility was built at Mahdasht to not only receive remote sensing imagery from satellites but also to process and distribute relevant imagery products to users throughout Iran for resource planning and management. Iran became only the fourth country after the USA, Sweden and Brazil to install such a ground receiving station, and for some time the Mahdasht Satellite Receiving Station was one of only a few major sites capable of acquiring data from Landsat. Over the years, Mahdasht has supplied data to assist in identifying areas for development, and it has enabled scientists to identify areas that are prone to earthquakes, floods, landslides and other natural threats. It has also been used to investigate greenhouse gas emissions and air pollution in large urban areas, and to monitor wetlands, inland water basins, and the environment of the Caspian Sea and the Persian Gulf.

The Iranian Remote Sensing Center was established in 1973 to operate the Mahdasht facility. In their first cooperative program in space technology the USA and Iran agreed that this facility should directly acquire data from the satellite and that Iran should supply this data to the 33 countries within the antenna coverage of Mahdasht. A contract was signed in 1974 between Iran and the US General Electric Company to install the receiving station. Construction began in 1976 and the station became operational in 1978. The start of the revolution in 1978 caused General Electric to leave the country and suspend the project implementation. The only legal governmental body for issuing remote sensing data

in Iran, IRSC has been involved in the application of Earth space data for a quarter of a century. It has also controlled the development and implementation of various applications as well as the research projects and programs requested by different organizations and institutes. Furthermore, IRSC has pursued research in the development of remote sensing technology, in particular involving the development of a CCD sensor.[177]

The Mahdasht Satellite Receiving Station is currently affiliated with the Iranian Space Agency and is known as the Alborz Space Center. At the time of its establishment it occupied an area of 43ha but has now expanded to 180ha on a sprawling tract at the base of some hills. The site contains numerous satellite dishes, the buildings housing control rooms for monitoring the satellites, and other facilities. The stages of activity and development of the station since its establishment in 1972 can be chronicled as below, but it must be recognized that its development and progression in each period was always influenced by the driving attitudes and vision of the authorities and decision-makers.

1972 to 1979

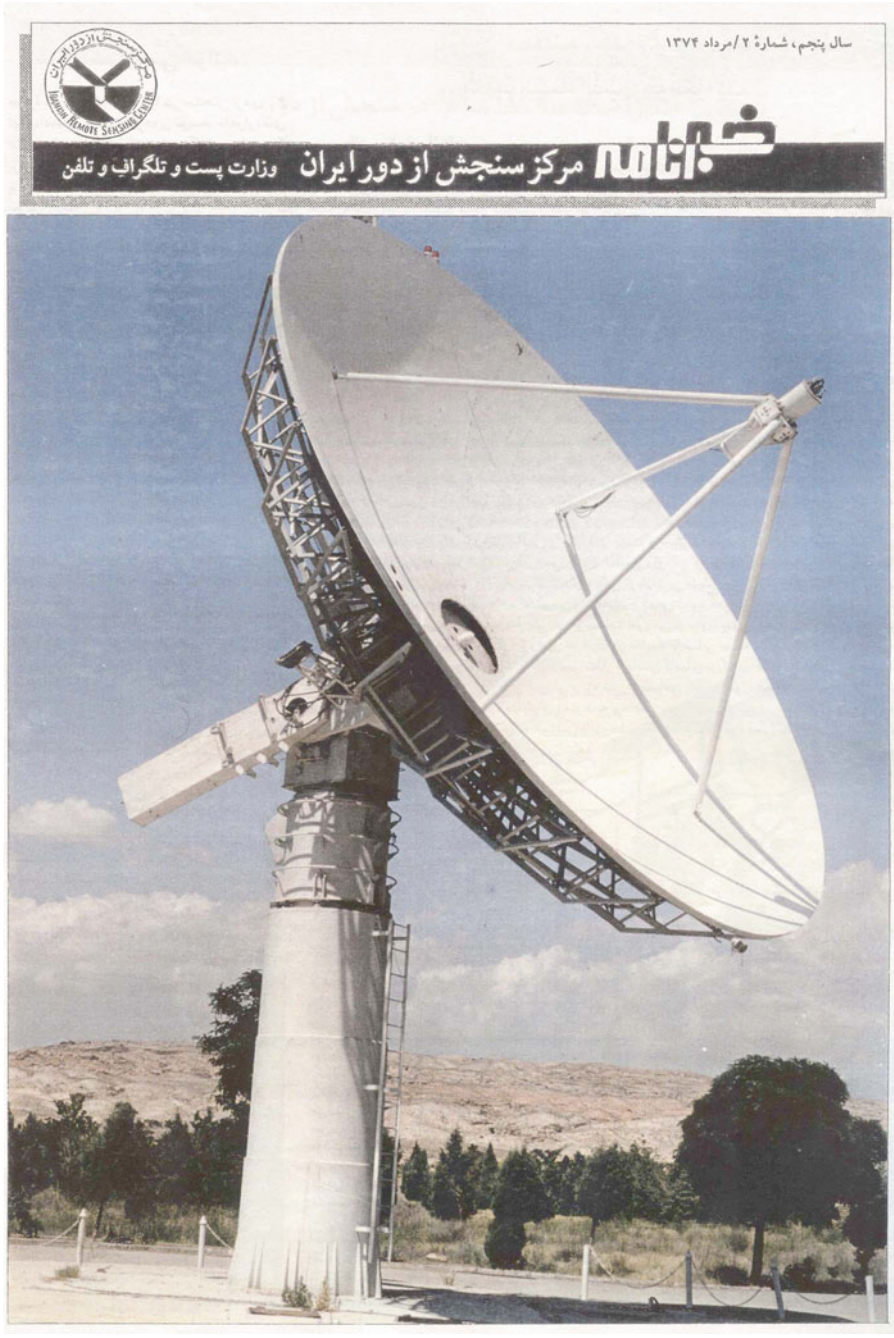
With the launch of the US Earth Resource Technology Satellite in 1972, Iran expressed its interest in remote sensing technology and this can conveniently be considered the starting point for such space-related activities in the country. Shortly thereafter, Iran established an office for data collection in the Planning and Budget Organization. Iran enthusiastically endorsed the global advancements that were being facilitated by the rapid development of space technologies, and remote sensing in particular. With the support of the USA, Iran decided to proceed with the direct acquisition of satellite data, and in 1974 a contract was signed with the General Electric Company to construct and operate a satellite data receiving station. At the same time, under the Plan for Satellite Data Applications, these remote sensing activities were officially assigned to National Iranian Radio and Television (NIRT). Mahdasht was selected as the site of the satellite receiving station. The installation process began in 1976, and by 1978 the tracking and data acquisition functions had become operational. For Landsat-1 to -3 an 18-day recurrence period was needed during which it was possible to acquire a full coverage of the globe. The Mahdasht operators succeeded in acquiring three separate full data sets for Iran and this data was archived by the station.

In accordance with common procedures for satellite data acquisition in the USA, Canada and some other countries, the contract between Iran and the General Electric Company specified five phases for commissioning the receiving station, namely installing and operating the facilities for (1) tracking the Earth resource satellites and direct data acquisition from them, (2) recording and data correction, (3) analysis and data processing, (4) data management and (5) data printing, proliferation and production.

In parallel with equipping the Mahdasht Satellite Receiving Station, the authorities launched plans to identify, employ and train staff to operate the facilities. The employees and engineers were proud to be assigned to such an innovative project. But the onset of the Islamic revolution in Iran in 1978 and its victory the following year curtailed work of the station and prompted the rapid departure from the country of the American contractor. This left Iran to manage the implementation of the project on its own.[178]

1979 to 1991

The Islamic revolution in Iran had its own vision for the future of the country, with novel attitudes to management. The completion of the Mahdasht Satellite Receiving Station was



4.6 The antenna of the Mahdasht Satellite Ground Receiving Station on the cover of the bilingual *IRSC Newsletter* which was published by the Iranian Remote Sensing Center. The Landsat Receiving Station is currently inactive, but this 10m antenna was capable of receiving Landsat 1-2-3 MSS and RBV as well as NOAA-AVHRR with spatial resolutions of 80m, 120m and 1,100m respectively. [*IRSC Newsletter*]

4.7 Firouz Naderi (b.1946) was born in Shiraz. As a scientist, he worked at the Mahdasht Satellite Receiving Station as the technical deputy to the director of the Plan for Satellite Data Applications. In 1979 he joined NASA's Jet Propulsion Laboratory (JPL). As head the Mars Exploration Program in 2000 he managed the program that successfully landed the Spirit and Opportunity rovers on Mars. He is currently JPL's director for Solar System Exploration. [Kodoom]

not a priority, and the project stagnated. The collective dismissal of qualified employees for political reasons was destructive and irreversible. A mood of suspicion predominated. In addition to those discharged, rejected or fired, many employees with highly specialized knowledge either quit or took early retirement in disgust at the unbearable environment.

One noteworthy victim of this situation was Firouz Naderi. Although at that time the judgment of his dismissal seemed difficult, more than three decades later it is apparent that the rejection of such a qualified expert and son of his land from the Mahdasht Satellite Receiving Station was unwarranted. Born in Shiraz in 1946, Naderi became a scientist, and he is currently the director for Solar System Exploration at NASA's Jet Propulsion Laboratory (JPL). In this role, Naderi oversees the planning, development and operation of robotic solar system missions, including currently active projects such as the Cassini orbiter at Saturn, the Dawn spacecraft in the asteroid belt, and the Juno spacecraft now bound for Jupiter. Naderi was assigned to head the Mars Exploration Program in 2000 after that had suffered two consecutive failures. He turned that program around with the Mars Exploration Rovers, Spirit and Opportunity.[179] His time at JPL has covered systems engineering, technology development, and program and project management for satellite communications systems, terrestrial remote sensing astronomical and astrophysical observatories, and planetary missions.[180] In 1964 he went to the USA to study for a bachelor's degree in mathematics at the Iowa State University. He received his MSc and PhD in electrical engineering from the University of South California, specializing in digital image processing. He returned to Iran in 1976 and worked at the Mahdasht Satellite Receiving

Station as the technical deputy to the director of the Plan for Satellite Data Applications, who was simultaneously the director of NIRT. In the wake of the revolution in Iran he was dismissed by the new authorities. Several months later he joined JPL. At that time he was 33 years of age. According to Naderi's colleagues at that time, several people were instrumental in his dismissal but chief amongst them was Sadegh Ghotbzadeh (1936-1982), managing director of what was then NIRT, who took over the position of Reza Ghotbi immediately after the revolution. It seems Ghotbzadeh expelled Naderi and commanded him to return to the USA. Ghotbzadeh was a close aide of Ayatollah Khomeini during his 1978 exile in France, and Iran's Foreign Minister from November 30, 1979 to August 1980 during the Iran hostage crisis which followed the revolution. In 1982 Ghotbzadeh was executed for allegedly plotting to assassinate Ayatollah Khomeini in order to overthrow the Islamic Republic.[181] After being appointed the managing director of NIRT, Ghotbzadeh tried to overhaul this entity by a mass purging of its staff in order to fall in line with the new government's policies. As the Plan for Satellite Data Applications was under NIRT at that time, Ghotbzadeh would have had a close view of its work and activities.

Nearly a decade after the revolution the importance of space technology caused the new regime to revive the ground receiving station, but by then the installed systems were obsolete and unusable. As a consequence of both mismanagement and global sanctions against the country, the plan to upgrade the facility was unsuccessful. The rulers put a lot of effort into encouraging foreigners to upgrade the station but political factors, including Iran's non-compliance with global agreements, principles and treaties on the use of space and its related technologies, particularly satellite technology and remote sensing, made this impossible. The plans for the development of Mahdasht were put on hold and its future was uncertain. The experts, engineers and middle-rank managers who had survived the purge attempted to save the station. They tried to convince the decision-makers that it was essential to the nation to continue the work of such a station because of the role that remote sensing and other space technologies could play in the informed management and control of resources. Despite the changing times, the people at the station managed to maintain and operate the facilities in such a way that not only direct data acquisition from meteorological satellites became possible, but training and complete management of data was institutionalized. Management of the station was shifted back from NIRT to the Planning and Budget Organization.

The main and considerable success for the Mahdasht Satellite Receiving Station realized by the efforts of employees of the station during this period were as follows:

- Operating and conducting the installed facilities to achieve direct data acquisition from meteorological satellites in the NOAA series.
- Training experts and technologists of the user organizations and institutes throughout the country for technology transfer of satellite and space applications.
- Installing and operating the second, third, fourth and fifth phases of the station for data production and proliferation.

The production of satellite data and the full coverage of Iran in the station's archive provided the possibility of using satellite data for implementing projects and plans across the country and holding workshops for the transfer of knowledge and expertise of satellite data applications.

1991 to 1996

In accordance with the efforts made by experts for the development of remote sensing technologies throughout Iran during the previous period, there were some official commitments to transition from the Plan for Satellite Data Applications and further institutionalize remote sensing activities. In 1991 the parliament of the Islamic Republic of Iran passed a law to transfer it from the Plan for Satellite Data Applications to a state-run entity known as the Iranian Remote Sensing Center (IRSC) affiliated with the Ministry of Post, Telegraph and Telephone (MPTT). In the early 1990s responsibility for all aspects of remote sensing was transferred to IRSC. This introduced legal problems for the Mahdasht Satellite Receiving Station in terms of funding and an inability to undertake the necessary plans and programs. It was therefore decided that IRSC should be downsized and that activities at Mahdasht be minimized, resulting in a temporary suspension of activities there.

1996 to 2004

Although the downsizing of IRSC led to a temporary suspension of the activities of the Mahdasht Satellite Receiving Station, before this came into effect it was possible to complete the fifth and first phases, including data production and proliferation, and to continue at a very low level of activity to receive data from meteorological satellites.[182] As a result of MPTT organizational and administrative changes made over several years, in December 2003 it became the Ministry of Communications and Information Technology (MCIT). In February 2004 the Iranian Space Agency was set up and tasked with all remote sensing activities in the country. As a direct result, the Mahdasht station was revived and the cautious resumption of reconstruction begun in 2003 was accelerated. The Landsat antenna was abandoned but receiving facilities at Saadat Abad north of Tehran were gradually transferred to Mahdasht.

2004 to date

The Iranian Space Agency created in 2004 gained responsibility for all remote sensing activities in the country. The authorities were strongly in favor of the reactivation of the Mahdasht Satellite Receiving Station. All of the active receiving facilities at the agency's Saadat Abad headquarters north of Tehran were gradually relocated to the Mahdasht Satellite Receiving Station. New specialists and other staff were employed. Although the antenna for receiving Landsat data had been abandoned, other facilities could receive data from the latest generation of satellites including Terra-MODIS, IRS and NOAA, and plans are in hand to receive data from other satellites. This was in accordance with the mandate to concentrate all ISA remote sensing activities at Mahdasht and further develop that site to become the Alborz Space Center. Some of the plans for this development have been finished and others are still underway. When completed it will host a variety of ground space complexes and laboratories as well as work, living and leisure facilities for Iran's space science and technology specialists, scientists and officials.[183] Nowadays, data from commercial remote sensing satellites is widely used by a variety of organizations and institutions in Iran for research and development programs. Mahdasht has stored about 15 years' of AVHRR (Advanced Very High Resolution Radiometer) data from satellites of the US-NOAA (National Oceanic and Atmospheric Administration) series. It is also capable of receiving data in both the S-band and X-band frequencies that are used by existing and future satellites. It also has taken data from the NASA Terra-MODIS (Moderate

Resolution Imaging Spectro-radiometer) and the Russian OKEAN satellites. The receiving station for data acquisition from the MODIS sensor was put into service in October 2001. In September 2002 the station was enabled to receive data from the Indian Remote Sensing (IRS) satellite. Since 2004 these activities have been performed by the Alborz Space Center for the Division of Remote Sensing of ISA.

4-3-2 Managers of the Iranian Remote Sensing Center

The managers of the Plan for Satellite Data Applications and later the Iranian Remote Sensing Center played a key role in advancing activities. However, this author has failed to uncover any documented information about the early decade of the life of the Plan, mainly due to the turmoil of the early years after the revolution and because most of the documents were either destroyed or were not recorded properly. The only sources in this regard were the recollections of my colleagues who were working with the Plan and are now almost all retired. Although they kindly shared their memories, for which I am truly grateful, the story remains somewhat incomplete and unclear.

The first director of the Plan for Satellite Data Applications that was initiated under the Deputy of Informatics at the Planning and Budget Organization was Khosrow Behrouz. He was a civil engineer who studied at Tehran University and was the director general of the Now-Fan [New Technology] Company involved with civil engineering issues. Reportedly, he passed away in 2009. His successor was Khosrow Ebtehaj, a geologist with a PhD degree. He was the nephew of the well-known Gholam Hussein Ebtehaj (1897-1967), who was in charge of Iran Tour and Iranian Airways, mayor of Tehran and a member of parliament. His other uncle was Abul-Hassan Ebtehaj, the head of the Planning and Budget Organization. At that time, the Plan was conducted under the Deputy of Informatics at the Planning and Budget Organization. After its transfer to National Iranian Radio and Television, it seems very likely that Khosrow Ebtehaj was replaced by Reza Ghotbi. However, some believe that a man by the name of Ali Ghazi also worked in the capacity of director of the Plan for a while, assisted by Vardex Israili. Ghotbi, who directed the Plan when it was transferred to NIRT, was also director general of NIRT. The common procedure was that either the Deputy of Informatics at the Planning and Budget Organization or the director of NIRT held the responsibility to conduct the Plan or gave that responsibility to their deputy, who served as the director of the Plan. Ghotbi was reportedly the cousin of Farah Diba, the last queen of the Pahlavi dynasty and currently the exiled Empress of Iran. Born in 1939 in Tehran, Ghotbi was a politician in addition to being the managing director of NIRT from 1966 to the 1979 revolution. He gained the directorship of NIRT when he was 27 years of age. He was at the same time a professor of mathematics at the Aryamehr University of Technology that was renamed the Sharif University of Technology after the revolution. Apparently Bahman Jazayeri and Firouz Naderi assisted Ghotbi in directing the Plan for a short period of time.

After the 1979 revolution, Reza Ghotbi was dismissed and Sadegh Ghotbzadeh succeeded him at NIRT. For the next six years, the directorship of the Plan rapidly passed through a series of men who were at the same time deputies of the respective managing director of either NIRT or the director of the Planning and Budget Organization. According to my sources these men were Homayoun Sharif-panahi, Ali Izadpanah, Seif-ullah Ehdaie,

4.8 Reza Ghotbi (b.1939) was simultaneously the director of National Iranian Radio and Television (NIRT) and director of the Plan for Satellite Data Applications. [Wikipedia]

[Dr.] Parvin, Hussein Razavi, Ali Kolahdooz, Muhammad Hussein Sharifzadegan, [Dr.] Pashaie, Iraj Sadighian, Ibrahim Matin Rad, and [Mr.] Davari-Nejad. In 1985 Farshid Jahedi was appointed, and things improved. In the course of his directorship, the Plan was changed to a state-run entity named the Iranian Remote Sensing Center. It was in 1991 that the parliament of the Islamic Republic of Iran passed the law that transferred the Plan for Satellite Data Applications to the Iranian Remote Sensing Center that was mandated to work under the Ministry of Post, Telegraph and Telephone, to which the senior officers of the IRSC would report.

Farshid Jahedi was born in 1954 in Shiraz. He gained directorship of the Iranian Remote Sensing Center affiliated with the Planning and Budget Organization of Iran when he was 31 years of age and led it for 12 years. He was the first director of the IRSC to attempt to make it the focal organization in Iran for all international space-related activities. With an excellent command of the English language and public relations, he initiated IRSC's participation in international deliberations on behalf of Iran and organized remote sensing-related international meetings and forums. He used the benefits which arose from the internationalization of the IRSC to reward his entourage and favorite staff. He was an open minded and smart businessman who saw the technology of remote sensing as an opportunity to establish a business. As a result, he did not make much effort for the growth of the technology itself but promoted the business-oriented vision of remote sensing technology and geographic information systems. He privatized remote sensing activities by encouraging the establishment of firms offering careers in such applications with the specific focus on business, which was beneficial for him and his entourage.

4.9 Farshid Jahedi (b.1954) was director general and chief executive officer of the Iranian Remote Sensing Center from 1985 to 1997. [Farshid Jahedi's page @ Blogger]

Following the presidential elections of June 1997 in Iran, Farshid Jahedi was succeeded by Ahad Tavakoli. On leaving the Iranian Remote Sensing Center for the Shahid Beheshti University based in Tehran, he accepted the position of deputyship for financial issues. Formerly known as Daneshgah-e Melli, this was the institution where Jahedi obtained his master's in architecture. However, at the age of 46 he became the first Iranian exchange student from this institution to attend Stanford University in the USA on a program reportedly initiated and funded by Stanford University.[184] According to his LinkedIn web page, he spent 2000 to 2002 there as a research scholar in the field of architecture and urban design. Introducing himself as a project manager, designer, and senior architect working and living in New York, USA, Farshid Jahedi refers to his study at the University of Pennsylvania for a master's in architecture in urban design during an undated period of study. It is likely this was in the years 1998 to 2000, immediately after he left Iran and prior to attending Stanford University to study for a PhD, although it is unclear whether this first Iranian exchange student was successful in gaining his doctorate there. His cited study for a master's in architecture at the Shahid Beheshti University is also undated, but it was probably prior to 1985. Although Jahedi was always dismissive of efforts to increase knowledge and accomplishments in space and remote sensing-related studies, deeming it to be futile – as the author well remembers from meetings with him at the IRSC – he personally seized upon the chance to attend Stanford University, not so much to learn but as a means of advancing his business career.

It was with such a vision that Jahedi left Iran in 1997 and it was in the last days of 2008 that news about him hit the headlines. As the president of the Alavi Foundation, he was arrested on a charge of obstruction of justice for allegedly destroying documents required to be produced under a grand jury subpoena concerning the Foundation's relationship with

the Bank Melli Iran and the ownership of an office building located in Manhattan in New York, USA. On his web pages, Jahedi states he worked with the Alavi Foundation from 2007 to 2009. According to the civil lawsuit which was filed by the judicial agents of New York, the Foundation was owned by companies that illegally sent funds to the Iranian government. The Alavi Foundation was the successor organization of the Pahlavi Foundation, a non-profit organization originally operated by the last Shah of Iran, Muhammad Reza Pahlavi, as a means of pursuing Iran's charitable interests in the USA. In the 1970s the Pahlavi Foundation built an office tower in New York whose construction was funded by the state-owned Bank Melli Iran. After the revolution in Iran the Pahlavi Foundation was renamed the Mostazafan Foundation of New York, and later the Alavi Foundation. The Alavi Foundation claimed to be devoted to promoting Islam and the Persian language. However, based on the prosecutors, the Foundation was a means for the Iranian government to transfer rental income from its properties over to the Bank Melli Iran, which was first subject to US sanctions in 2007 for allegedly supporting Iran's nuclear program.[185] In 1989 the Alavi Foundation formed a company in partnership with the Bank Melli Iran and later transferred one third of the company's assets to the Assa Corporation based in Jersey on the Channel Islands of the United Kingdom. The Assa Corporation was wholly owned by Iranian citizens representing the interests of the Bank Melli Iran.[186] On April 29, 2010 it was officially announced that a Manhattan federal court had sentenced him to 3 months in prison as a result of having pleaded guilty to two felony counts of obstructing justice by destroying documents concerning the Alavi Foundation's relationship with the Bank Melli Iran and the ownership of an office tower in Manhattan. In addition to receiving a prison term, he was also fined.[187,188] Interestingly, by the time of his trial, Jahedi was also a US citizen in addition to his Iranian citizenship.

The case of Farshid Jahedi and the manner in which he moved from the Iranian Remote Sensing Center to financial intrigue in New York by exploiting state privileges and rents is indicative of the web of influence in the USA that is operated by the post-revolution government of Iran. In seeking probation, Jahedi said to the judge, 'I want to show everybody that I regret my action, and I want to show my children not to be disappointed in their father.'[189]

4.10 An aerial view of the Mahdasht Satellite Receiving Station taken in July 1997. [IRSC]

Table 4.5. A chronology of the Iranian space endeavor from the Plan for Satellite Data Applications to the Iranian Space Agency in the years 1972 to 2013. [Author].

Behrouz	Ebtehaj	Ghotbi	Ehdaie	Parvin	Razavi	Pashaie	Sadighian	Jahedi	Tavakoli	Amidian	Shafti	Talebzadeh	Taghipour	Forghani	Fazeli	
Plan for Satellite Data Applications									Iranian Remote sensing Center (IRSC)			Iranian Space Agency (ISA)				
72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Civilian era																																	Transition from civilian to non-civilian era				Non-civilian era				

Ahad Tavakoli, a professor at the Electrical Engineering Department of the Amir-Kabir University of Technology, was appointed as director of the IRSC in September 1997. He was a manager with the spirit of technocracy and considerably reinvigorated the development of remote sensing technology at the Iranian Remote Sensing Center. He joined the IRSC as director general and chief executive officer at a time when the government was seeking to increase the involvement of the academic sector in the managerial issues of the country, in accordance with changes in the state vision after the elections of 1997 in which Muhammad Khatami was elected as the President of Iran. The board of directors of the IRSC consisted of the general director and two other persons. During the directorship of Tavakoli, the other board members were Mehdi Hashemi Rafsanjani Bahremani, the son of the former president of IR Iran, and Ahmad Talebzadeh. They were both on the board of directors of the IRSC from 1997 to 2004, when the activity of the IRSC was concluded and ISA was founded. In fact, Hashemi became a board member earlier than 1997.

Born in 1958, Ahad Tavakoli achieved his bachelor's and master's degrees in electrical engineering respectively in 1982 and 1984 from the University of Kansas, Lawrence, USA. He graduated with a PhD in electrical engineering from the University of Michigan, Ann Arbor, USA, in 1991. His education was more relevant to his leadership of the IRSC than was so for both his predecessors and his successors. He was the first director to promote the technology of remote sensing, as opposed to focusing on its applications and business. He significantly increased the contribution of the IRSC and the country in space-related activities internationally, and steered it to an unprecedented position that was very different from that sought by his predecessor, Farshid Jahedi. In particular, he initiated the organized participation of Iranian scientific and technical delegates in space-related forums, the most important being COPUOS and its subcommittees. For the first time, Iran was selected to become a COPUOS Bureau member (2004-2006) and it chaired an action team of the Recommendations of the UNISPACE-III as established in 2001.

Ali Asghar Amidian took over as director general and chief executive officer of the IRSC after Tavakoli's early resignation in September 2002. Amidian was born in 1959 in Birjand. There is no authentic record of his academic study and background.[190] It is very likely that he benefited from state privileges in acquiring a graduate degree in communications from the Telecommunications Training Center of Iran and the Amir-Kabir University of Technology. He even carried out his studies whilst employed by the Ministry of Post, Telegraph and Telephone (MPTT). For his doctorate in electrical engineering from the University of Laval in Canada, he grabbed a rent-like opportunity gifted by the authorities of the MPTT for a 7-year period. A significant amount of state funding was expended for his self-styled academic study in Canada. However, there is no published outcome recorded for him anywhere regarding his doctoral study.[191] He entered the IRSC in the expectation of being appointed the first president of the Iranian Space Agency but he missed the mark and this post went to Hassan Shafti who had greater competency and eligibility. This was fair since, regardless of the claims made on his personal weblog established for the parliamentary elections in 2006 in Iran,[192] he was neither the founder of the space agency nor capable of gaining a position at the UN-COPUOS for Iran. The establishment of the space agency in Iran cannot be attributed to an individual person because it was the result of a collective effort by many people over the course of many years in different successive phases. As regards gaining a position at the UN-COPUOS for Iran, as far as the author (as

4.11 Ahad Tavakoli (b.1958) was the director general and chief executive officer of the Iranian Remote Sensing Center from 1997 to 2002. His education in electrical engineering and microwave remote sensing was far more relevant to the task than was the case for either his predecessors or his successors. [AUT-EE]

the holder of this position) has witnessed of the current selection procedure in Vienna in Austria, he played a worthless and even a preventative role in the process. It was really the Ambassador of Iran to the UN in Vienna at that time, Dr. Pirouz Husseini, who paved the way for this. It was Husseini who made possible the selection of the author as a member of the COPUOS Bureau, both by his insistence upon the author's nomination by the home authorities and by his diplomatic discussions with COPUOS members and the authorities of the Committee Secretariat, Office for Outer Space Affairs. Amidian was incapable of negotiating this because he lacked the required qualifications. As one of the bullies of the inner circle of power in the MPTT, Amidian widely exploited state privileges and rents to progress officially and occupy highly ranked positions. His main effort was to organize the National Committee for Preparing the Draft of the Statute of the Iran's Space Agency (NCPDSISA) that drafted the statute to establish the agency. The committee was hosted by the IRSC, which he headed, since this was the national organization for space-related issues. It was parliamentary approval of the statute that led to the formation of the Iranian Space Agency in February 2004.

4.12 Ali Asghar Amidian (b.1959) was the director general and chief executive officer of the Iranian Remote Sensing Center for 16 months until its incorporation into the Iranian Space Agency in 2004. [TCI]

Although Amidian missed out on becoming the first president of ISA he was the last president of the IRSC, a position that he held for only 16 months with the least relevant background to remote sensing. With the help of his deputies Ali Asghar Dowlatabadi and Muhammad Mehdi Salehfard for administrative and financial issues and technical support issues respectively, Amidian transferred a considerable amount of the IRSC's sources, including facilities and finance, to a private firm named Aseman-e Aabi (Blue Sky) that he founded jointly with his colleagues. The Iranian Remote Sensing Center became the main pillar of ISA, and remote sensing has continued as part of the space service activities under the agency.

4-4 IRAN'S SPACE COMMUNICATIONS

Establishing the Asad-Abad Ground Station and installing the facilities for connecting to the Pacific Intelsat for international communications in 1969 indicated the decisive intention of Iran to use space communications in the framework of international cooperation for the national and domestic benefits and needs. Space communications is now widespread in Iran and is considered a basic component for telecommunications, television

broadcasting, navigation, tele-education, weather forecasting, Internet connectivity, relief and rescue, etc. Iran entered the space applications era by installing a standard-A antenna with a diameter of 30m at the Asad Abad Ground Station in order to connect into the Pacific International Telecommunications Satellite Organization (Intelsat) for international communications. The telecommunication network in Iran is essentially based on a microwave backbone with reasonable coverage in the well-populated provinces. In general, there are three communications networks with a total of over 1,000 ground stations providing voice and data services to users. The number of fixed communication lines increased from 10 million in 2000 to 12 million in 2003, indicating that one in five of the Iranian population owns a phone line thanks to the availability of space communications technology.[193] International communications is mainly handled by the Intelsat and Inmarsat satellite networks through more than 3,500 channels and three international gateway Earth stations, namely:

- The Shahid Ghandi satellite communications center (formerly called the Asad-Abad Satellite Communication Center) was established in Asad-Abad, Hamadan in 1969 with two standard-A antennas and one standard-B antenna for Intelsat satellites at 335.5ºE, 359ºE and 60ºE with 1,654 circuits.
- The Boumehen satellite communications center was established in 1987 northeast of Tehran, with one Intelsat standard-A and one standard-B antenna with 1,332 circuits, and one antenna for communicating with the Inmarsat network. This center has one main domestic station and a HUB station of the VSAT network. Moveable terminals of standard-A and standard-C have been set up to provide an international data communications network with various parts of the world.
- The Isfahan satellite communications center was established in 1987 and has a standard-B antenna for the Intelsat 62ºE satellite with 372 circuits. There is a plan to augment it with a standard-A antenna for the 64ºE satellite.

It is notable that Iran has already established 3,358 satellite circuits that directly connect with 48 countries and transit through 182 countries. International communications via Intelsat employ three ground stations and IDR/DCME equipment through six satellites in geostationary positions over the Atlantic and Indian oceans. The Inmarsat satellite network is used for mobile land and marine traffic. The coastal stations for this network are at the Boumehen satellite communications center within the Inmarsat system-A (telephone, telex, data) and Inmarsat system-C (telex) and operate via the Indian Ocean Region (IOR) satellite.[194]

Domestic satellite communications extend communications facilities to remote villages and thinly populated areas where the establishment of any type of terrestrial communication would be either not technically practical or economically unsound. A considerable number of remote stations located in villages in all provinces enable their residents to communicate right across the country. The national Domsat system was put into effect in 1990 by implementing phase 1, which consisted of seven hubs and 61 terminals arranged in seven star sub-networks. The technology used was a single channel per carrier quaternary phase shift keying frequency division for multiple access through the transponders of the Ku-band East Spot of the Intelsat 63ºE satellite. The ground segment was later augmented by the installation of two star networks comprising of two hubs and 900 very small

4.13 A view of the Boumehen satellite communications center, established in 1987 to the northeast of Tehran, with one Intelsat standard-A and one standard-B antenna. [H. Majnoonian]

aperture terminals (VSAT) accessing the same satellite using the time division multiple access (TDMA) technique. In addition, a separate nationwide network consisting of two hubs and some 1,700 VSATs owned and operated by the Central Bank of the Islamic Republic of Iran is now in service.

The Telecommunication Company of Iran (TCI) then added nine gateway hubs and 300 demand-assigned multiple access ground stations using TDMA, all in the 14/11 GHz band. This is intended to improve rural and remote area communications, and to satisfy the need for applications such as data transfer, multi-point-to-point, point-to-point, short-term and emergency services and Internet links. It is believed that satellites are a practical solution for rural locations that are either far from terrestrial telecommunication links or are inhibited by barriers or other technical problems. In this regard, TCI provides satellite communications to 2,000 rural locations and around 500 suitably equipped private users. Moreover, TCI plans to provide telemedicine and tele-education services for locations that are within easy access of the central hospitals and universities. There is one Inmarsat ground station near Tehran providing services to a fleet of ships and land-mobile terminals of standard-A and standard-C. In addition, TCI plans to cooperate with Intermediate Circular Orbit (ICO) Global Communications, an offspring of Inmarsat, to provide mobile satellite services across the region. It also intends to join various well-established low-Earth orbit systems such as Globalstar and networks for global mobile personal communications by satellite (GMPCS).

The Islamic Republic of Iran Broadcasting Organization (IRIB) has implemented many expansion projects that make effective use of three 72 MHz Ku-band transponders on the 63ºE Intelsat satellite. Four national television channels now broadcast nationwide, making use of 2,600 television receive-only terminals, establishing almost complete national television coverage. IRIB has also initiated a Ku-band television broadcast to Europe and

the Middle East using a European Telecommunications Satellite Organization (Eutelsat) satellite. It also owns two C-band ground stations which relay news items to the Asiavision network and internationally through Intelsat. Two mobile ground stations can provide satellite news gathering transmission from any point in Iran and neighboring countries. IRIB also has 31 VSAT ground stations for its private communication purposes, and is in the process of transferring from analog sound and television to digital transmission via satellite. It is already using different facilities in order to broadcast and receive internal and external programs. These activities include the use of Intelsat, Eutelsat HOTBIRD-3 and TELESTAR-5 through the utilization of four fixed stations and three mobile satellite newsgathering stations.[195]

4-5 INTERNATIONAL COOPERATION IN SATELLITE MANUFACTURING AND JOINT SATELLITE PROJECTS

Iran has evolved two approaches to satellite projects. The first is the implementation of projects and joint ventures in cooperation with other spacefaring countries. Such projects include Zohreh, Mesbah, SMMS and Sina-1. The other approach is to design and manufacture the satellites domestically. The Omid satellite and its successors were developed in this way and they will be discussed in Chapter 8.

Both Zohreh and Mesbah were substantially based on bilateral and international cooperation, and despite positive interaction with the world community these projects failed because of inappropriate policies. SMMS was a multilateral venture by China under the Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA) initiative with Iran as one of the partners. In the case of Sina-1, Iran financed the project and assigned the manufacturing of the satellite to the Russian Federation, which managed the project even after the satellite was in space.

Long delays in the implementation of the Zohreh and Mesbah satellites led to a diminishment of quality in terms of the continuity of activity by the managers and staff and ultimately failures which served only to embarrass the country.

4-5-1 Zohreh (Venus)

Zohreh was begun in 1977 to develop a communications satellite system as Iran's first attempt at an independent space project. This geosynchronous satellite had originally been proposed earlier in the 1970s as part of a joint Indian-Iranian manufacturing project in which four Iranian satellites would be carried into space aboard the Space Shuttle then being built by NASA. Iran had also negotiated with France to make and launch Iranian satellites but nothing came of this. Despite the involvement of a number of national organizations in the development of the plans to put research satellites into space, Iran could not achieve these goals wholly indigenously and needed foreign technological assistance. After the refusal of Western countries to supply these technologies, Iran turned to the Soviet Union, China, and India, which at that time were the leading spacefaring countries. North Korea and later Italy were also partners of Iran in space research and development.[196]

Table 4.6. Details of the Iranian satellite projects prior to the launch of Omid. [Author].

Satellite	*Weight (kg)*	*Size (cm^3)*	*Orbit*	*Mission*	*Cost (million US$)*	*Launch Status*
Zohreh	NA	NA	Geosynchronous	Telecommunications	132	Never launched
Mesbah [1]	65	70x50x50	Sun-synchronous	Store & forward Communications	10	Never launched
SMMS	490	83x85x133	Sun-synchronous	Remote Sensing Environmental monitoring Communications	44	Launched by China under AP-MCSTA Initiative
Sina-1	160	80x130x160	Sun-synchronous	Remote sensing Disaster monitoring Communications	15	Launched by the Russian Federation
Omid	27	40x40x40	Sun-synchronous	Store & forward Communications	~0.5	Launched by Iran

Iran contracted with the M. F. Reshetnev Scientific-Production Association of Applied Mechanics (NPO PM) in the town of Zheleznogorsk in eastern Siberia to build the $132 million Zohreh satellite that was to provide Iran with various services, including television and radio broadcasting. NPO PM technicians were supposed to assist their Iranian counterparts in controlling the system in operation to maximize its functionality.[197] It was to use a Ku-band frequency for receiving and transmitting, with an Alcatel and Astrium payload which included 12 transponders consisting of eight units at 36 MHz and four units at 72 MHz. The satellite was to have an operating lifetime of 15 years. However, under international pressure in 2009 the Russian government withdrew from the project without supplying the satellite. Nevertheless, the Iranian authorities were eager to continue and in September 2010 they announced that the satellite would be manufactured and launched using domestic resources, and it is currently scheduled for launch in 2014 to provide numerous services including television and radio broadcasting, Internet connectivity, and e-mail access.[198,199] However, it remains to be seen whether this project will run to fruition.

4-5-2 Mesbah (Lantern)

The Iran Telecommunications Research Center (ITRC), Iranian Electronics Industries Organization, and the Iranian Research Organization for Science and Technology (IROST), in affiliation with the Ministry of Science, Research and Technology (MSRT), began to develop the Mesbah microsatellite in 1997 with the assistance of the Italian company Carlo Gavazzi Space (CGSC). The Iranian Institute of Applied Research was the primary constructor for the project. This was the first plan to build and launch a satellite by post-revolution Iran.

4.14 The Mesbah-1 satellite. [Iran & Power]

On August 4, 2005, the Mesbah satellite was showcased for the first time in an official ceremony. At that time it was scheduled to be launched in early 2006 on a Russian rocket. Once the satellite was operational, personnel from ITRC and IROST intended to control it during its 3-year lifespan from a ground station in Tehran. Mesbah was to greatly expand Iran's understanding of the practicalities of space technology, and create a solid basis for further projects. However, by 2004 it appeared that the project faced a number of technical difficulties.[200] The initial planning got underway in 1997, early in the administration of President Muhammad Khatami, and the prototype was built during 1999-2001. Mesbah was the first satellite that was to be designed and manufactured in Iran. It weighed 65kg and its dimensions were 70×50×50cm. The cost of the project was $10 million. The intention was to place it into a circular orbit at an altitude of 900km and control it from a ground station located in the ITRC, with the Italian company operating a backup station in Milan. At that altitude it would orbit the Earth 14 times daily, while being observable from ground stations four times every 24 hours. Although the satellite had an expected life span of 3 years, it was hoped that it would function for up to 5 years. It was designed to cover Iran, but would be technically capable of rendering services in Europe and the Americas as well.[201] Responsibility for undertaking the Mesbah project was given to ISA as soon as the agency was established in 2004, under the Ministry of Communications and Information Technology (MCIT).

However, Mesbah was never launched because both Russia and Italy terminated their cooperation with Iran on space projects. The project was superseded by Mesbah-2, which is to be constructed and launched indigenously by Iran. The Space Technology Group of the Electrical and Computer Science Engineering Department at IROST, which actively undertakes research and development in satellite payloads and ground stations, as well as aerospace applications, is applying the systems engineering design plan drawn up for Mesbah in the construction of Mesbah-2 for ISA.[202]

4-5-3 Small Multi-Mission Satellite (SMMS)

On April 22, 1998, Iran, along with China, South Korea, Mongolia, Pakistan and Thailand, signed a memorandum of understanding to build a joint Small Multi-Mission Satellite under the Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA) initiative. It would incorporate apparatus to perform disaster and environmental monitoring, civilian remote sensing, and communications experiments, would weigh 490kg and fly at an altitude of 650km in an orbit that was Sun synchronous. Iran's share of the US $44 million cost of manufacturing and launching the satellite is reportedly $6.5 million. Iran participated in this joint project because it was believed that access to data from advanced observation satellites would greatly benefit the country, particularly after natural disasters such as floods, droughts, typhoons, landslides and earthquakes. In particular it would assist emergency personnel and rescue and control organizations in better coordinating their relief efforts. The satellite was to be equipped with a low-resolution charge-coupled device (CCD) camera and an experimental telecommunications system. By agreement, Iran has contributed to the development of the CCD sensor. Some of the technologies used in this regard have enhanced Iran's long-term sensor design and manufacturing capabilities. The launch was initially planned for 2004, but a succession of

delays pushed it back to 2007.[203] The satellite, renamed Environment 1, was eventually launched by China, Iran and Thailand on September 6, 2008 on a Chinese Long March 2C rocket. It was one of a pair of Earth observation satellites on that vehicle. It is intended to establish a constellation of eight satellites. With a lifespan of more than 3 years, the satellites have onboard state-of-the-art imaging systems and infrared cameras enabling them to provide a global scan every 2 days.

4-5-4 Sina-1

With multiple technical difficulties delaying the implementation of the Mesbah satellite, the Iranian Institute of Applied Research (IIAR) requested Russian assistance to develop a microsatellite called Sina-1 that would achieve all of Iran's desired characteristics and functions. The Russian Federation developed the satellite and planned to launch it in September 2005. However, manufacturing delays postponed the launch by one month. The launch of Sina-1 made Iran the 43rd member of the world space club.[204]

The first Iranian satellite, Sina-1, was launched by a Russian Kosmos-3M rocket from Plesetsk in the Murmansk Province of the Russian Federation on October 27, 2005. The satellite has dimensions of 80×130×160cm, weighs 160kg, and cost US $15 million. It was inserted into a Sun-synchronous near-polar orbit at an altitude of 700km and has a period of 98.64min. It images the surface from the Arctic to the Antarctic. In panchromatic mode it images a swath 50km wide with a resolution of 50m, and in multi-spectral

4.15 The Sina-1 satellite. [Iran & Power]

scanning mode it images a swath 500km wide with a resolution of 250m. It is on a mission to study natural disasters, natural resources and agricultural trends. It operates on VHF and UHF frequencies. It has reportedly provided Iran with valuable experience in ground control tracking and telemetry handling.[205,206]

4-6 ACTIVATION AND REVIVING INTERNATIONAL ACTIVITIES AND CONTRIBUTION TO COPUOS

The onset of the Islamic revolution in Iran in 1978 and its triumph on February 11, 1979, led to the suspension of the country's participation and contribution to international activities and cooperation for a while. The new government halted all interactions in order to enable the incoming authorities to decide whether continuation of a specific international cooperation or relation would be of benefit to the country. Of course this was a time-consuming process, and everything was arrogantly considered with suspicion. The anti-US political program initiated by the new revolutionary government and the volatile conditions for foreigners involved in a range of projects and plans, caused almost all of them to hurriedly leave Iran. The exit of the American experts assisting with the creation of the Mahdasht Satellite Receiving Station put that project into abeyance. At the MSRS a considerable number of the installed facilities and tools were looted, and part of the fixed systems were damaged and broken by angry attackers and opportunists. As the situation continued to worsen, the government itself ruled against the presence of the Americans in Iran.

For a long time after the revolution, international cooperation and collaboration were considered with suspicion and refusal. It took essentially a decade for Iran to emerge from this shell of isolation and attempt to reactivate its previous cooperative trends and plans. But it was not easy, owing to both internal and external ill-treatment. The authorities and potential contributors to the international scene pursued a pragmatic approach. Reforms introduced after the presidential elections of 1997 replaced a sporadic involvement in international cooperation with the desire for regular contributions. This new policy was based on the belief that by developing rational international relations, most of the internal problems which faced the country would be eased. This new approach required a type of democratic openness and meritocracy. A high priority was assigned to positive international interaction in space applications and it was decided to take advantage of all feasible opportunities which were in line with the policy of reviving constructive international cooperation. Starting in the mid-1990s, the political and social climates in Iran began to moderate somewhat. Given this reform agenda, the government allowed more people to contribute, albeit only conditionally, to the social and political issues of the country. Bigotry began to fade, but was still an underlying issue. The Iranian Remote Sensing Center was assigned a key role as the national focal organization for space-related issues and activities. That is why it later became the main pillar of the Iranian Space Agency. After a long period of stagnancy, the government in Iran became active in the international arena to end its isolation. Space was one of the topics that the government came to understand was important to the future of the nation.

4.16 An appointment to membership of the COPUOS Bureau for the first time since its establishment in 1958 was the event that prompted Iran to decide to expand its international presence in the space field. The photos portray the author's contribution. [Author]

As the national entity in charge of space-related activities, the IRSC proposed reviving the Iranian participation in COPUOS and its Scientific and Technical Subcommittee meetings and deliberations. The author was selected by the IRSC to become the scientific and technical member of the delegation in 2000, and initiated this position by attending the 37th meeting of the subcommittee held in Vienna in February 2000. Starting in February

2001, I contributed to the establishment of Action Team No.1 of the Recommendations of UNISPACE-III (United Nations Third International Conference on the Exploration and Peaceful Uses of Outer Space), which had the mission 'to develop a comprehensive world-wide environmental monitoring strategy', and I co-chaired it for several years together with the Russian Federation and Syria. I later continued the chairmanship of the action team individually until 2007. Majid Hamadani, the consul of the Iran's Mission to UN in Vienna was assistive to the author in well implementing his responsibilities. From June 2004 to June 2006, I worked as a member of the COPUOS Bureau in the capacity of the Second Vice Chairman and Rapporteur.[207,208] I was the only Iranian to have been a member of the COPUOS Bureau since its establishment in 1958.[209] My nomination for membership of the COPUOS Bureau was carried out competitively. Although the authorities at IRSC and MPTT were reluctant to nominate me, preferring to nominate one of the deputies at MPTT, it was the Ambassador of Iran to the UN in Vienna, Dr. Pirouz Husseini and his assistant Masoud Rezvanian, who strongly supported my nomination and gained the support of other Asian members of COPUOS. Although my responsibility in that role ended in June 2006, my membership in Group-15, comprised of current, previous, and future COPUOS Bureau members, ran until the 51st COPUOS meeting in June 2008. Having an Iranian serve as a member of the COPUOS Bureau and chair Action Team No.1 of the UNISPACE-III Recommendations caused Iran to change its role in terms of motivating its international presence, a motivation that the author wholeheartedly supported.

In addition to the abovementioned constructive deliberations of the Iranian delegations on various space-related issues of technical and scientific concerns to legal aspects, Iran wished to engage in the global arena in order to use space peacefully. These efforts were strongly supported by the creation of the Iranian Space Agency in 2004, which organized and hosted many workshops and seminars related to space science and technology applications, placing special emphasis on remote sensing and disaster monitoring and mitigation. In this regard ISA worked in cooperation with UNOOSA, ISNET and other global and regional organizations and bodies. Iran was particularly interested in the endeavor to create a UN Space-based Platform for Disaster Management (SPIDER).[210] Iran has made many contributions as a member of ISNET, a non-political, non-profit agency that has an independent, autonomous and a self-governing identity under the umbrella of the Standing Committee on Scientific and Technological Cooperation (COMSTECH) of the Organization of Islamic Conference (OIC). ISNET was founded by nine OIC members, including Bangladesh, Iraq, Indonesia, Morocco, Niger, Pakistan, Saudi Arabia, Tunisia and Turkey. Syria joined in 1997, and Iran and Sudan joined in 2004, taking the membership to 12 countries. The organization is hosted by the Space and Upper Atmosphere Research Commission (SUPARCO) of Pakistan.[211,212] In the UN system, as one of the ratifying countries of the International Telecommunication Constitution and Convention, Iran has been an active member of the International Telecommunication Union (ITU), which was originally founded as the International Telegraph Union as a specialized agency of the UN responsible for issues that concern information and communication technologies, including space communications.[213]

At the regional level, Iran actively cooperates with the UN Economic and Social Commission of Asia and the Pacific (ESCAP) and abides by the plans and efforts made by its Regional Program on Space Technology Applications (RESAP). Iran and ESCAP have worked together at establishing a Center for Informed Space-based Disaster Management

4.17 A photo portraying a session of the Intergovernmental Consultative Committee (ICC) meeting of the RESAP of UN-ESCAP in Bangalore, India in 2004. The author is to the left of Hassan Shafti, the first president of the Iranian Space Agency. Those days offered much promise for Iran. But its unique active contribution to regional initiatives was subsequently undermined by the irrational and improper attitudes of the top decision-makers in space-related issues. [Author]

and an affiliated research center in the past years. ESCAP is the regional development arm of the UN within the Asia-Pacific region and it has a membership of 62 governments, 58 of which are in the region whose geographical scope spans from Turkey in the west to the Pacific island nation of Kiribati in the east and from the Russian Federation in the north to New Zealand in the south. It is the largest UN body and the most comprehensive of its five regional commissions.[214]

On the initiative of the AP-MCSTA, Iran cooperated in manufacturing a Small Multi-Mission Satellite for disaster management. The country joined the Convention of the Asia-Pacific Space Cooperation Organization (APSCO) under AP-MCSTA on October 28, 2005 as one of its founders and signatories along with China, Indonesia, Pakistan, Thailand, Bangladesh, Mongolia, Peru and Turkey. This was an important step for Iran in pursuing a new era in cooperative space activities. APSCO was established in January 2010, and Iran's contribution has been highly beneficial for the nation in the peaceful use of space science and technology. The objectives of APSCO are to focus on space science and technology, its applications, education and training, and to cooperatively carry out research to promote peaceful uses of outer space in the Asian region. It has the potential to become a successful organization like the European Space Agency due to the growing interest in space science and technology in the Asia-Pacific region. The major players are China, India, Japan and Australia, but South Korea, Thailand, Pakistan and Iran are advancing

rapidly. If these enthusiastic nations can join forces and pool their capabilities, they could save a lot of time and money by collective synergy and outcomes.[215] APSCO can play a key role in this regard, as can the Asia-Pacific Regional Space Agency Forum (APRSAF) to which Iran is eager to contribute.

Another space-related organization to which Iran belongs is the Committee on Space Research (COSPAR) of the International Council of Scientific Unions (ICSU), now the International Council for Science, which hosted its first Space Science Symposium in 1960. COSPAR was created by the ICSU in 1958 as an interdisciplinary scientific body concerned with the progress on an international scale of all kinds of scientific investigations carried out with space vehicles, rockets and balloons. Its membership consists of the National Academies of Science or their equivalent and the International Scientific Unions. Its highest body, which is its Council, includes the President, Representatives of member National Scientific Institutions and International Scientific Unions, the Chairs of COSPAR Scientific Commissions, and the Chair of the COSPAR Finance Committee. The COSPAR Bureau runs the Committee on a day-to-day basis between meetings of the Council.[216]

Given Iran's desire to be active in all international cooperation programs in space applications and science which would be to its benefit, the country has active memberships of the International Society of Photogrammetry and Remote Sensing (ISPRS), the Asia-Pacific Satellite Communications Council (APSCC), and the Asian Association on Remote Sensing (AARS). Although it has a distinctive Asian identity, the AARS attracts remote sensing scientists, advanced technologists, applications specialists, industrialists and entrepreneurs, as well as government decision-makers and planners throughout the region, Europe and North America. Iran has been a member of AARS since its establishment in 1981. Working hand in hand with governments, academic societies and education institutions, the AARS is a key partner in developing capabilities in space applications in the Asia-Pacific region, in particular, in close cooperation with ESCAP and RESAP. At least nine AARS members have been involved in the national Small Multi-Mission Satellite program.[217]

The International Society for Photogrammetry and Remote Sensing (ISPRS) is a non-governmental organization which is devoted to the development of international cooperation for the advancement of photogrammetry, remote sensing and spatial information sciences, and their applications. Established in 1910 by Professor Eduard Doležal from the Technical University of Vienna, Austria, ISPRS is the oldest international umbrella organization involved in the extraction of information from imagery. Its scientific interests include photogrammetry, remote sensing, spatial information systems and related disciplines, as well as applications in cartography, geodesy, surveying, natural Earth and engineering sciences, and environmental monitoring and protection. Further applications include industrial design and manufacturing, architecture and monument preservation, medicine and a variety of others.[218] The Iranian Remote Sensing Center was the member of ISPRS, together with the National Cartographic Center of Iran. In 2004 the Iranian Space Agency took the place of IRSC, which it superseded as the nation's main entity for international cooperation in space.

The Asia-Pacific Satellite Communications Council (APSCC) is a non-profit association for space-related industries, and its membership includes private and public companies, governmental entities, and academic and research entities. Its objective is to promote communications and broadcasting via satellites, as well as other space

4.18 The award ceremony for the Eduard Doležal Prize 2000 in the course of the Second General Assembly Meeting of ISPRS XIX Congress on Tuesday, July 18, 2000 in Amsterdam, the Netherlands. On behalf of the Austrian Society for Surveying and Geoinformation (VG), Professor Karl Kraus (1939-2006) presents the prize to (from left to right) Dr. Ivan Katzarsky of Bulgaria, Professor U. R. Rao of India, and this author, the first and only Iranian winner of the award. The ISPRS XIX Congress was held on July 16-22, 2000. The award has been presented since 1992 on the occasion of the Congress of the ISPRS by the Austrian Society for Surveying and Geoinformation in commemoration of Professor Dr. Eduard Doležal, the ISPRS founder. It is awarded either to individuals who have fully implemented a practical application of photogrammetry, remote sensing or GIS in an efficient manner, or to those who achieved outstanding success in a field which supports photogrammetry, remote sensing or GIS. [ISPRS]

activities in the Asia-Pacific which would benefit the socioeconomic and cultural welfare of the region.[219] Iran has certainly benefited greatly from its long membership of this important association.

Finally, it should be recognized that almost all of Iran's endeavors in implementing its satellite projects such as Mesbah, Zohreh, SMMS and Sina-1 have been the result of international cooperation. The same goes for the establishment of the Mahdasht Satellite Receiving Station and the installation of other space ground stations and facilities.

As explained earlier, the Iranian Space Agency was established with a mandate for all civilian applications of space science and technology. That was a long and practical step forward, not only towards advancing space science and its related technologies but also to increase cooperation at the international level for this very laudable purpose. Promoting the applications of space science and technology for peaceful purposes was a central part of the Iranian strategy. This also recognized the need for increased public awareness, capacity building, research and the exchange of experiences in parallel with the expansion of bilateral and multilateral cooperation at regional and global levels. In addition to Iran's

4.19 Conducting the deliberations of the ICC meeting of the RESAP-ESCAP in Isfahan, Iran in September 2005. The author is the second person from the right. The first person from right is Ahmad Talebzadeh, looking thoughtful. In October, he succeeded Hassan Shafti as ISA president upon the resignation of the latter. [ISA]

4.20 A photo from the OOSA's exhibition in June 2007 which celebrated about 50 years of COPOUS activity. It was taken during the 46th COPUOS meeting in Vienna, Austria, June 2004. The author is the first person on the right. [OOSA]

efforts in this regard, the need to expand national capabilities in the application of technology was always understood. This was recognized in the mid-term and long-term plans which focused on Earth observation and led to the emergence of the satellite manufacturing industry.[220]

It is noteworthy that the considerable success in the international arena which was achieved in the course of the first presidency of the Iranian Space Agency has never been repeated. The subsequent presidents did nothing but disrespect the high values of the agency and undermine its achievements. Given the state of international relations in 2005, attention turned to the development of specialized scientific and technical relations and efforts to cancel or mitigate the sanctions that were imposed on Iran following the revolution. However, after 2005 the focus of international interaction became an exercise in scouting and stealthy security monitoring. The majority of the Iranian members in the delegations sent to international meetings and programs after that were security officers holding dummy positions in the entities that they nominally represented. This has diminished the reputation of the Iranian space endeavor in the global arena, with predictable results. In recent years, for example, the number of members of Iranian delegations to international meetings, particularly COPUOS and its subcommittees, have considerably increased. Many of these people are there not to participate in the scientific or technical discussions but for entirely different reasons. Although there is an increase in the number, the quality – with the exception of one or two people – has declined. Those people are affiliated officers to security and non-civilian entities. They use membership of the delegations as a cover for their own activities. Moreover, since 2007 the spirit of Iran's international involvement has changed from cooperation to one of opposition and suspicion. Nowadays, the Iranians at international space meetings are people who purport to represent relevant entities but are not knowledgeable of, or competent in the technical fields. The office for specialized international cooperation has consequently been reduced to a family circle that acts as the logistics office for the travel of its staff as well as high ranking employees of the agency and other entities.

5

Legislation, managerial and administrational turmoil

Iran's Fourth Five-Year Development Plan ended in 2009 and the Fifth Five-Year Plan was approved by the parliament on January 4, 2011 to begin implementation in that year. This continued to favor the development of space technology and applications as an effective tool for the sustainable development of the country. Moreover, according to the Twenty-Year Vision Decree issued on November 4, 2002, resources must be devoted to increasing the country's contribution to global scientific production. In particular, the Decree said that Iran should gain access to new technologies including nanotechnology, biotechnology, information and communication technology, environmental technology, and aerospace and nuclear technology. By 2025, at the close of the period covered by the Decree, it is expected that Iran will have become the leading nation in the development of space technology and applications in the Middle East. It was this vision that created the incentive to reorganize the Iranian space endeavor and institutionalize it by the establishment of a national space agency.

But before the Iranian Space Agency could be established there were some preparations that had to be carried out, the most important being to organize the National Committee for Preparing the Draft of the Statute of Iran's Space Agency (NCPDSISA) and this was hosted by the Iranian Remote Sensing Center (IRSC), the leading entity for space-related issues. The IRSC was affiliated with the Ministry of Post, Telegraph and Telephone (MPTT) which later became the Ministry of Communications and Information Technology (MCIT). The Committee's mission was to prepare the draft of the statute of the space agency, and this received final approval in June 2005. The membership consisted of three main groups: representatives from the academic sector, MPTT and non-civilians. The author was the secretary of the Committee, which was active until November 2003. The non-civilians believed that the space agency should be an administration to serve as a showcase for their space activities. It was their belief that space and space technologies were primarily tools for national security and assisting the military. (Sad to say, this point of view has been accepted by the authorities of the current space agency since 2008.) In contrast, the MPTT members of the NCPDSISA strongly believed that space and space technology applications in Iran should be regarded simply as an activity in the context of space communications and they suggested that the new agency should be named the Iranian Space Communication Organization, but this too was rejected. The majority of the

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The whole text of

Iran's Twenty-year Vision Decree

issued by the leader of the Islamic Republic of Iran

on November 4, 2002

Trusting in God's immortal power and in light of belief, national will and the organized and collective effort, and in the route of the fulfillment of the goals and principles of the [country's] Constitution, according to theTwenty-year Vision Decree, Iran is a developed country of first position in economy, science and technology in the [South-west Asia (including central Asia, Caucasus, Middle East and the neighboring countries)] region with the Islamic and revolutionary identity, inspirational in the Islamic world and with the effective and constructive interaction in international relations.

Iranian society at the end of this [Twenty-year] Vision Decree, [in 2025] will attain the following achievements:

- Developed in accordance with its cultural, geographical and historical circumstances, reliant on ethical principles and Islamic, national and revolutionary values, emphasizing on religious democracy, social justice, legitimate liberties, preserving the human munificence and rights, and benefiting the social and judicial security;
- Privileged of the advanced science, capable in producing science and technology, reliant on high contribution of human resources and social assets to national production;
- Secure, independent and powerful with a defense system based on holistic prevention, and the unity of the nation and government;
- Privileged of safety, welfare, nutrition security, social security, equal opportunities, well-distribution of incomes, firm family basis, free of poverty, discrimination and benefited of favorable environment;
- Active, responsible, dedicated, devout, satisfied, enjoyed of conscience, discipline, cooperativeness and social consistency, obliged to the revolution, Islamic regime, Iran's flourishing and honored to be an Iranian;
- Attained the premium economic, scientific and technological position in the South-west Asia (including central Asia, Caucasus, Middle East and the neighboring countries) emphasizing on the software revolution and scientific production, fast and continuous economic growth, relative increase of per-capita income and providing the employment opportunity for the whole;
- Inspirational, active and effective in the Islamic world through strengthening the religious democracy, effective development, ethical society, intellectual and social innovation and dynamism, and effective on the Islamic and regional convergence based on the Islamic doctrines and the thoughts of Imam Khomeini;
- Being in the constructive and effective interaction with the world based on the principles of respect, wisdom and prudence

[*Unofficial translation by: Parviz Tarikhi-May 14, 2009*]

5.1 The deliberations of the National Committee for Preparing the Draft of the Statute of the Iranian Space Agency were hosted by the Iranian Remote Sensing Center in November 2003. The author is in the middle of the photo. [ISA]

academic membership argued for integrating air and space activities into a single aerospace organization. A minority of the academic membership believed that space should be separate from the long-established aeronautics sector in Iran. The NCPDSISA sent a draft statute to the preparatory commission of the parliament, which, after consulting pertinent dignitaries, sent it for parliamentary approval.

A law for space activities which complied with Iran's legal and administrative infrastructure and promoted its requirements in this area was essential to the national space endeavor. However, as in the other domains in Iran, achieving the appropriate management and administration was not simple. A clear understanding of the procedures by which a law will be implemented will indicate whether it will be able to be applied successfully. In Iran almost everyone considers it essential to assess human resources issues and matters of management and administration in terms of competence, but judging competence is a subjective process. It is therefore essential to identify what the pertinent authorities consider to be meritorious. In practice, the criteria for assessing competence seriously influence the process of legislation to pass laws and the later implementation of those laws. The management and administration of space activities in Iran was no exception. This situation originated from the social, political and even cultural relations, and more comprehensively from the prevailing relations in the country. In recent decades this has been based on the granting of privileges to social classes in Iran including the clerics, groups of non-civilians, specific religious sects, security forces and individual para-militia people who show loyalty to the government. Such privileges apply to their relatives and offspring as well. There is no legal basis for this. It is a decadent social class system. Of course, it is possible for knowledgeable and competent people to emerge from the favored classes of this society,

but they devote their efforts to preserving those privileges. Consequently there is little observance of the democratic and humanitarian criteria that are accepted and desired by the majority of the Iranian people. The result is a fully non-normative system which is unjust, irritating and disappointing in its decision-making.

This chapter reviews not only the efforts to establish a legal regime for Iran's space activities but also, given the society in that country, the nature of its management and administration.

The institutional background of the Iranian space endeavor can be divided into four main periods, with each period starting with an event that became a turning point. The first period started with the creation of the Iranian Space Agency. The second period began with the revisions to its managerial orientation following the presidential elections of 2005. The third period began with approval of the new statute for ISA and its ensuing feudalization. The fourth period began with the transfer of ISA to the Presidential Institution, an arrangement whose legal and administrative ambiguity still persists.

5-1 APPROVAL AND ESTABLISHMENT OF THE IRANIAN SPACE AGENCY

On December 10, 2003 the parliament of the Islamic Republic of Iran approved Article 9 of the Law for Tasks and Authorizations of the Ministry of Communications and Information Technology which called for the establishment of a new regime for dealing with the nation's outer space issues. The state took the first step in implementing the new law on February 1, 2004 by assigning the first president of the new entity named the Iranian Space Agency (ISA). Affiliated to the Ministry of Communications and Information Technology (MCIT), ISA was established in the form of an autonomous organization mandated to implement strategies authorized by the Space Supreme Council (SSC), which was itself legitimized by the approval of the same law.[221] This law was given the final approval of the Guardian Council of the Constitution of IR Iran on June 18, 2005.[222]

Based on the approved statute, ISA was mandated to address and support all activities in Iran that related to the peaceful application of space science and technology under the leadership of the SSC, which was chaired by the president of the state.[223] The relevant clause of the approved bill was 'The Space Supreme Council, under the leadership of the President of the Islamic Republic of Iran, shall seek to apply space technologies for peaceful uses in space and protect the national interests and the sustainable exploitation of space science and technologies for the economic, cultural, scientific and technical development of the country.' The Council's main goals were:

1. Policy-making for the application of space technologies to peaceful uses in outer space.
2. Policy-making in manufacturing, launching and use of national research satellites.
3. Approving space-related programs of the state and private institutions and organizations.
4. Approving the long-term and short-term programs of the country's space sector.

5. Promoting partnerships between the private and cooperative sectors for efficient uses of space.
6. Identifying guidelines concerning the regional and international cooperation on issues relating to space, and clarifying the position of the Islamic Republic of Iran relative to these bodies.[224]

The SSC was not an organization as such but a board of people at ministerial level. Its secretariat was performed by ISA. The ISA president was simultaneously the secretary of the SSC and the Vice Minister of Communications and Information Technology.[225,226] The SSC included various observers and advisors, but its main members were:

- President of Iran who was simultaneously the president of SSC.
- Minister of Communications and Information Technology.
- Minister of Science, Research and Technology.
- Minister of Defense and Armed Forces Logistics.
- Minister of Foreign Affairs.
- Minister of Industries and Mines, which was merged with the Ministry of Trade in 2011 to establish the new Ministry of Industry, Mines and Trade.
- Minister of Roads and Transportation, which merged with the Ministry of Housing and Urban Development in 2011 to establish the new Ministry of Roads and Urban Development.
- Director of the IR Iran Broadcasting Organization.
- President of ISA who was simultaneously the secretary of the SSC.[227]

The establishment of the Iranian Space Agency was contemporaneous with the final years of the second term of Seyyed Muhammad Khatami as state president. His election in June 1997 initiated a wave of reforms in the social, political, scientific and technical aspects of the country. During these years, Iran reorganized and enhanced its positive interaction with the world community in relation to international cooperation on the

5.2 Seyyed Hassan Shafti served as the first president of the Iranian Space Agency from February 3, 2004 to October 18, 2005. [Book City]

peaceful uses of space, efforts which had been initiated earlier in the decade. Believing it was necessary to involve the academic sector in administration and management in order to achieve reforms, the scholars, university professors and tutors were invited to contribute. The top managerial positions of the state-run organizations and institutions were left to the academic scholars as secondment posts. But the plan failed to attain success because of the social, political and cultural problems facing the country, and people with competency in scientific and managerial fields were never really given priority.

On February 3, 2004, Seyyed Hassan Shafti became the first ISA president. Prior to this he was the director general of the state-run Iran Air for a period of 12 years, then the Ambassador of the Islamic Republic of Iran to Spain for 5 years. He founded the Iranian Aerospace Society and played a key role in establishing the Aerospace Research Institute (ARI). Shafti was born in 1939 in Isfahan as the son and grandson of two leading clerics, and studied aerospace in the United Kingdom. As events would show, he was the only competent and reputable ISA president, playing a positive and effective role in institutionalizing civilian space activities and promoting the peaceful uses of space technologies. His diplomatic background as an ambassador, his scientific and technical background as a leading member of the aerospace community, his international background particularly in the administrative and legal aspects pertaining to aerospace in the course of managing Iran Air, and his decades-long managerial experience made him very suitable for such an important position. In the course of his presidency, he pursued an influential cooperative policy in the agency's interaction with the rest of the world in terms of space science and technology. The most notable of his achievements were developing an active and dynamic contribution to the UN Committee on Peaceful Uses of Outer Space (UN-COPUOS) and the Inter-Islamic Network on Space Technology (ISNET) at the international level, and the initiative of the Regional Space Applications (RESAP) under ESCAP (Economic and Social Commission of the United Nations in the Asia-Pacific Region), as well as the Small Multi-Mission Satellite (SMMS) project, and establishing the Asia-Pacific Space Cooperation Organization (APSCO) at the regional level via the Asia-Pacific Multilateral Cooperation in Space Technology Applications (AP-MCSTA).

Shafti also developed a reasonable cooperative relationship between ISA and the academic sector, particularly the creation of a research institute for space science and technology. Moreover, he made every effort to maximize cooperative relations between his agency and its counterparts at home and abroad on the simple principle of creating mutual respect and benefit between scientific, technical or educationally based entities. He encouraged able and competent people, both inside and outside the agency, to contribute to the progress of the only civil entity representing the Iranian space endeavor. Although the period of his presidency was too brief to implement far-reaching and long-term plans, he ran the agency in such a manner that wisdom and respect were its guiding principles. (Unfortunately, this was not so for the four presidents who followed him.) In his dealings with both insiders and with foreign authorities, Shafti refused to apply the strategy of double-crossing. He insisted that developing a rational international cooperation and interaction with the world community would resolve many of the problems faced by Iran in general and its space endeavor in particular.

Although the first president of ISA was different in personality, mentality and characteristics from most other managers in Iran, he was a reputable, pragmatic fellow who was

trusted not only by the government but also by the public. He was one of only a few eligible and circumspect managers in the country, and very often gave the appearance of being a saint seeking salvation for something that was not apparent. The author worked closely with Shafti during the entire period of his presidency at the agency, and in later years when Shafti was the senior advisor to the fifth president of the agency. He believed the author to be an honest technocrat who deserved his professional respect. Shafti liked Iran and its glories and indeed was a real patriot. Respecting Iranian dignitaries of science and culture, he loved Umar Khayyam and his vision about the universe in particular, and was proud of other Iranian poets and scientists.

The first ISA president sought mutual respect both in and out of the country. He was genial with the staff of his agency. The door of his office was always open, and everyone who wished to visit was assured of a warm welcome. He would listen to anyone's concerns and offer helpful advice. Under the unique style of his management, the agency was progressing to become a center of excellence with a good reputation both at the internal and international levels.

5-2 CHANGE OF THE STATE AND ORIENTATION

The presidential elections of June 2005 in Iran gave rise to considerable changes in the policy and orientation of the government, both domestically and internationally. This gradually but markedly affected the policies of the space agency and significantly revised the nation's space endeavor. On October 18, 2005 the first ISA president resigned and was succeeded by Ahmad Talebzadeh. Prior to the establishment of the agency, Talebzadeh was a member of the board of directors of the Iranian Remote Sensing Center from 1997 to 2004. His fellow board members were Ahad Tavakoli, who also served as the director

5.3 Ahmad Talebzadeh was the second president of the Iranian Space Agency from October 18, 2005 to July 29, 2008. [Fars News Agency]

general and chief executive officer of the IRSC, and Mehdi Hashemi Rafsanjani Bahremani, the son of Ali-Akbar Hashemi Rafsanjani Bahremani, the former President of Iran and one of the dignitaries and the founders of the Islamic Republic. Even earlier, Talebzadeh was a member of the board of directors of the state-run shoe-making company of Kafsh-e Melli (National Iranian Shoe Company) in Tehran. As the core entity in establishing ISA, IRSC played a key and pivotal role in paving the way for the country's only civil space administration.

Talebzadeh was born in 1957 in Tus in the Khorasan Province of Iran (currently located in Khorasan Razavi Province) as the son of a local merchant. His educational background is ambiguous and is reported differently by different sources. According to his curriculum vitae, which has been posted at the official website of the United Nations Office for Outer Space Affairs (UN-OOSA), albeit undated, his background was aerospace,[228] but the official website of ISA and other local sites give his background as industrial engineering.[229–231] He was reportedly involved with so-called diplomatic and monitoring issues at the Embassies of Iran in both Austria and Germany for around 8 years during the course of the crisis of the Iranian embassies in the 1980s.[232,233] Despite his claim to have studied for bachelor's and master's degrees in an English-speaking country, his proficiency in that language is unlikely to have enabled him to successfully undertake an academic degree in science and technology at an American university. Whatever his main function or mission might have been while he was living abroad, it is unlikely to have been studying at a higher education level. Some eyewitnesses confirm that in the course of his stay abroad in the early decade after the Iranian revolution he was one of the leading activists of the Islamic Students Association in Europe and the USA.[234] This is possibly why he was easily authorized to involve himself with the diplomatic issues at the Embassies of Iran in Austria and Germany in the 1980s. He raised a lot of criticism both globally and domestically, particularly after leaving his position as the second president of ISA owing to poor management skills and the abuse of his authority.[235–238] His orientation on issues pursued by the agency differed markedly from those of his illustrious predecessor, and the constructive and positive era of the first presidency rapidly faded. He had a complicated and ambiguous character, and he was dishonest and malicious. When he took over the agency, numerous staff who had served ably under his predecessor were simply fired and others were banished, subjected to severe insult and financial and work pressures. Many incompetent and unskilled people were given key management positions, many of whom had been expelled by the first president in response to their poor qualifications and evident incompetence. This was simply Talebzadeh settling old scores. It was certainly a poor way to prepare the agency for an unknown imperative new order.

On the international policy and plans of the agency, almost all activities under Talebzadeh were either idle or were counter to the previously established direction. In the course of his presidency of the agency, international cooperation in the space arena declined markedly. Limitations were placed on the contribution of Iran to the UN-COPUOS. The situation was scarcely moderated following the criticism by the Office for Outer Space Affairs at that time.[239] As a result, Iran failed to play a worthy role in the COPUOS deliberations, failed to properly chair and conduct Action Team No.1 of the Recommendations of UNISPACE-III, and failed to contribute to the work of the other action teams. Meanwhile, the proposals of Iran to UN-ESCAP and AP-MCSTA were defeated. In particular, the decision on Iran's proposal for the establishment of a center for informed disaster

management fell into abeyance. Iran's role in the interim committee for establishing APSCO also faded because of the country's poor participation in the committee meetings. And in COPOUS, Iran's position regarding the UN Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) program was limited to the domestic level.

ISA continued to operate under the supervision of the SSC until August 2007 when the state, with the approval of the Administrational Supreme Council, in line with the implementation of the Fourth Development Program of the country, established the Supreme Council of Education, Research and Technology by merging the 12 supreme councils for Science, Research and Technology, Information Technology, Communications, Space, Atomic Energy, Communication Media Security, Education and Training, Educational Revolution Logistics, Informatics, Science Applications, Biotechnology, and Standards. But the new Supreme Council of Education, Research and Technology was itself dissolved in February 2008 and its functions given to the newly established Science, Research and Technology Commission under the Cabinet.[240,241]

In the meantime, Talebzadeh made an attempt to develop cooperation between his agency and the academic sector for scientific and technical exchange and transfer, but the relationship was limited to business issues in which the agency was only playing a financial sponsorship role. This situation was due to the absence of sufficiently practical and competent scientific and technical staff in the agency and the fact that the academic sector, in response to political pressure, was ignoring its scientific and technical responsibilities and confining itself to easier, safer and lucrative business issues. Almost all of the universities were being emptied of their noble and broadminded professors, tutors and scholars. What remained were people whose primary interest was the advancement of their personal situations. Nevertheless, Talebzadeh attempted to follow-up his predecessor's initiative by establishing a research institute affiliated to the agency. This finally began its activity in October 2007 as the Space Research Institute (SRI).

The second president of ISA was dismissed in August 2008. He was later nominated to work with APSCO as the director general of its Department of External Relations and Legal Affairs, starting in January 2010 when APSCO itself was officially established. In addition, based upon the nomination made by the Iranian authorities, he worked in the capacity of chairman of the Legal Subcommittee of COPUOS for the period of 2010-2011, although reports online say that his performance gave rise to considerable resentment.[242–246] The behavior of the second ISA president was therefore very different to that of his predecessor. His arrogance and indecency disinclined people to seek him out to discuss matters informally and he was reputedly incapable of rational argument. His entourage were sycophants who dared not cross him. As a result, the bold vision held by the agency in the course of the first presidency was undermined.

5-3 NEW STATUTE AND MARTIAL FEUDALIZATION AT ISA

The dissolution of the SSC in 2007 prompted a revision of the ISA statute to allow it to act based on legislation and approved laws and regulations. On June 15, 2008 the Council of Ministers approved the amendments to the statute of June 11, 2005. This was followed by investigations by the Guardian Council of the Constitution of the Islamic

Republic of Iran as a preliminary to the final approval that was granted on July 2, 2008. These actions were believed to be a practical step which would not only focus the Iranian space endeavor on the advancement of science and technology for effective use of space for peaceful purposes but also enhance the nation's cooperation at the international level. The new statute embodied the proposal of the Ministry of Communications and Information Technology (MCIT) and was in line with Article 44 of the Constitution of Iran which called for the assignment of non-sovereign tasks to the private sector and the centralization of sovereign tasks previously carried out by different specific organizations.[247]

Given this statute, ISA became responsible for the implementation of legal tasks, undertaking studies, research, engineering and operations in space technologies, remote sensing, and improving communications and space technology networks both inside and outside the country, as well as those sovereign tasks of the former Iranian Remote Sensing Center and MCIT. Further, ISA tasks included formulating space sector programs, study and policy-making in designing, manufacturing, launching and using national satellites. ISA was also made responsible for ground control centers, planning the development of peaceful uses of space and space technology, strengthening the national, regional and international communication networks by the state and cooperative and private sectors.[248] The most important change in the 2008 statute was placing ISA under the administration of MCIT, to which it reported. In this manner, the supervision of ISA by the SSC under the leadership of the President of Iran was voided. In this new arrangement, the president of the agency, being the Deputy Minister of Communications and Information Technology, was presumed to be the highest authority responsible for implementing the affairs of the agency, and for protecting its rights, interests and assets.[249] This was actually an indication of the degradation of the position and confinement of the agency, although the new statute provided ISA, and hence its president, with more financial authorization to regulate its efforts for the institutionalization of space activities to achieve its goals.[250] Moreover, the new statute also authorized ISA to establish research centers and firms subject to the approval of the Council for Development of Higher Education, a task not included in its former statute. In addition, the new law authorized ISA to receive approved tariffs for offering space services, obliged the space agency to act based on the rates approved by the Cabinet, and to settle its funds to the state public revenue account. Moreover, in line with Article 68 of the Law for Management of Country Service approved in 2007, the space agency, in coordination with the Management and Human Assets Development Deputyship of the President of the Islamic Republic of Iran, was authorized to make necessary superior payments with the endorsement of the Cabinet to draw and retain appropriate human resources for specialized and managerial posts.[251]

On July 29, 2008, less than a month after the approval of the new statute, Reza Taghipour Anvari was appointed as president of ISA. This was an appropriate and tempting occasion for the incoming president to manage the agency because its annual autonomous budget had risen to $4 billion.[252] He enthusiastically continued the policy initiated several years earlier by his immediate predecessor of appointing non-civilians. Prior to this, Taghipour had held the position of the deputy director general of the Iranian Electronics Industries Company (SAIran) affiliated with the Ministry of Defense and Armed Forces Logistics for a period of 8 years.[253] His study background is not clear in terms of time and congruity as

5.4 Reza Taghipour Anvari was the third president of the Iranian Space Agency from July 29, 2008 to September 29, 2009. [IRNA]

recorded in domestic official documents and websites. However, he probably studied computer engineering, industrial engineering and lastly system management.

It should be noted that owing to the expertise, knowledge and ability crisis of the top managers in Iran since the early days of its inception, the government chose to officially nominate almost all of those individuals whose academic backgrounds were deficient to courses at leading universities so that they could obtain academic degrees. The universities were obliged to accept them, even if they missed the required entrance qualifications. The inevitable result was complimentary higher education degrees. Over the course of the years since the early 1980s this strategy has led to a tremendous decline in the value of the academic education, the emergence of wide discrimination in the academic and research environment and corruption at the managerial level. SAIran, from which the third and later the fourth presidents of ISA came, is a non-civilian telecommunications company that developed the first Iranian indigenous low-orbit experimental satellite Omid (Hope). SAIran was founded in 1972 by the simple expedient of combining different manufacturing plants and companies across the country which were working in electronics, optics, electro-optics, communications, computers and semiconductors. With six subsidiaries and 5,000 staff, including 700 engineers in different disciplines, SAIran developed an expertise in

research and development that now serves as the technological backbone of the company. Its subsidiaries included Shiraz Electronics Industries, Iran Communications Industries, Information Systems of Iran, Electronic Components Industries, Isfahan Optics Industries and the Iran Electronics Research Center.[254] In the first three months of Taghipour's presidency of ISA, its former authorities exploited his ignorance and lack of information on the status of the agency's operations. The middle level managers protected themselves from the results of their previous incompetence by hiding facts from him and briefing in a favorable light.

The aerospace activities of Iran have always been attributed to the contributions and assistance of the non-civilian sector. As related in Chapter 2, the role and influence of the non-civilian sector in the development of the Iranian aeronautics endeavor is undeniable. However, why has it not been as promising in the space arena? One reason is that before the socio-political uprising in Iran which resulted in the revolution of 1979, the non-civilian sector consisted of individuals who, by their braveness, devotion and patriotism, set out to respect and advance the glory, honor and reputation of their country and nation all around the globe. As a result, the contribution of the non-civilian sector was based on integrity and sincerity and it shared its abilities, potentials, knowledge and skills with the nation. After the revolution, the non-civilian sector was divided into two parts: those of the pre-revolution military forces and those of the new military forces created to protect the revolution, with the main players being the Guardian Corps of the Islamic Revolution and the paramilitary Basij forces. The pre-revolution non-civilian entities were quietly abandoned and the new ones received the highest support and credit. Because the core vision of the new military forces was a form of religious order, the previous, laudable characteristics failed to receive respect. The majority of the Guardians were arrogant individuals lacking in formal education and competence. The result was eminently predictable. In the past the contribution by the non-civilian sector was performed by honest cooperation with the civilian sector. In particular, non-civilian entities did not seek to gain the upper hand, undermine the civilian sector, or interfere in the realm of the civil activities. After the revolution, non-civilian entities were authorized to breach the previous modalities and enter domains which were beyond their capacity, knowledge and experience. The non-civilians who joined the space agency mainly came from the Guardian Corps of the Islamic Revolution, known generally as the Revolutionary Guards. This was a fully hierarchical system with principles and regulations in common with a military system. The members were obliged to obey the orders of their superior commanders and issue orders to their inferiors, irrespective of whether those orders were wise. In this situation, the members were denied the capability to verify, investigate and understand the individual issues. This was completely contrary to the basic personal requirement for working in an institution like a space agency that was a civilian system provisioned to be a center of excellence. These non-civilian people required some superior to think on their behalf and order them around. Such a phenomena was unprecedented in the history of the development of aeronautics and astronautics in Iran.

The author was present when Taghipour made his introductory remarks on August 5, 2008 upon taking over as the third president of the agency. He mandated the personnel to work hard to develop satellites because the Imam Mehdi (Imam Zaman) needed satellites and atomic bombs to expand his governance around the globe. According to Shiism, the

ideology of the current rulers of Iran, Imam Mehdi is the leader of the Shiite Islamic sect. Although the Imam has been absent for 1,400 years his followers await his return to rule and spread justice. However, it is their view that he will not return until the world is awash with corruption, injustice, horror, fear, terror and ravage, with honest people suffering under oppression. Naturally his acolytes feel obliged to provide these conditions. The third ISA president believed this, and also insisted that the objective of delegates of the agency attending international events should be to repulse evil, an idea that was counter to the high and valuable ideas behind the philosophy and policy for establishing ISA. Hence security officers and non-civilians in plain clothes came to dominate the Iranian delegations.

The Iranian parliament judged the dissolution of the councils to be illegal, so reinstated them. The Guardian Council of the Constitution of Iran returned the approval of the parliament for revision and amendments. Then on September 27, 2008 the Expediency Council mandated the state to restore the dissolved councils after 8 months of dissolution. The revival of the SSC made necessary a mandatory change in the 2005 ISA statute. This was to ratify the relationship of the revived SSC with ISA, and redefine the functions and duties of ISA based upon the aims and mandates of the SSC.[255] In practice, due to disputes between the state and the parliament, this ratification was never achieved. The lack of SSC supervision and control for a period of about 5 years has led to turmoil in the functioning of ISA in terms of concentrated and comprehensive policy-making, the efficient management of resources and the implementation of space-related plans. Given the administrative situation legitimately presented by the authorities to ISA, and particularly to its president, and the considerable budgets provided to that agency by the state, ISA really became a state contractor for the commissioning of so-called research and experiments by academics, non-civilians and the private sector, in many cases with similar aims to parallel endeavors. The outcome, following the launch of Omid, was a roughly three-fold growth of Iranian satellite plans.[256]

Taghipour was born in 1957 in Maragheh, northwest of Iran, the son of a local merchant and one of the famous usurers of his hometown. After the revolution of 1979 he joined the Guards as soon as this was established, with the main objective of protecting the assets of his father from confiscation by the new government and its revolutionary forces.[257] On August 19, 2009, a few months after the disputed presidential elections of that year, he was assigned the Minister of Communications and Information Technology. It was ludicrous that a person of such poor qualifications was able to climb the ladder of progress so rapidly. The prevailing clandestine atmosphere of ISA was made worse by the arrival of Taghipour as its third president, particularly because of the absence of transparency, the intimidation, menace, inquisition and rascality employed by the top authorities of the agency in dealing with issues and staff. Taghipour was the first non-civilian president of the agency to fully establish a security and non-civilian environment, a situation that persists to the present day.

The launch of the Omid satellite significantly raised the profile of ISA, even though the agency had no role in its manufacture and launch – it was developed by SAIran. Taghipour was still in charge of the agency at the time of the launch. A month after becoming Minister of CIT, he appointed Muhammad Ali Forghani, his former assistant at SAIran, to run ISA.

5.5 Muhammad Ali Forghani was the fourth president of the Iranian Space Agency from September 29, 2009 to September 29, 2010. [ICT]

Born in 1957 in Yazd, the capital of Yazd Province in central Iran, Forghani gained his education in system management and strategic management in the Iranian Science and Technology University and the non-civilian University of National Defense, although his education period is undated.[258] He became the fourth president of ISA on September 29, 2009 and continued to send out international delegations composed primarily of non-civilians in plain clothes, and in particular security officers. On leaving the agency after one year he was appointed by the Minister of Communications and Information Technology (that is, his patron, Taghipour) to chair both the Communications Infrastructure Company (CIC) and the Communications Regulatory Authority (CRA).[259]

The appointment of Taghipour as Minister of CIT opened the full hegemony of the non-civilians to this important ministry that controls and manages all communications-related activities in the country. ISA continued to suffer from the malice of its third president after

his appointment as the Minister of CIT. Although he has always denied knowledge of the satellite signal jamming, the source of which was traced to Iran in the final months of 2012, the international community shunned him. He was assisted by Forghani as head of the CRA. Use of satellite signal jamming apparatus in Iran is exclusively under the control of non-civilians at MCIT. The Minister is a high ranking officer of the Guardian Corps of the Islamic Revolution, and the Ministry itself is mainly under GC control and ownership. There is clearly a governmental concern for satellite signal jamming. In the big cities, particularly the capital, many people complain about such apparatus. There is much medical evidence, but the government is deaf to complaints and disrespects both international regulations and the rights of the people living in the country.[260]

The management of ISA by its third and fourth presidents was performed in a terrible manner; indeed, they were not managing. They remained in their rooms with their doors closed. They devoted no time to their personnel. Imitating them, their deputies and middle ranking managers did the same. Conversations and exchanges of ideas and opinions with them was impossible. These arrogant men were only interested in associating with their non-civilian colleagues or the affiliates assigned to the agency by the non-civilian sector. Only the security personnel and non-civilians were unchallenged operators at the agency's headquarters in downtown Tehran and its various other branches.

5-4 ANNEXATION AND PERSISTENCE OF AMBIGUITY

In an administrative reshuffle, the fourth president of ISA was dismissed on September 29, 2010. The agency was annexed to the Presidential Institution, and Hamid Fazeli took office as its fifth president on November 15, 2010. He was to work under Esfandyar Rahim Mashaie, a close relative who was secretary of the Presidential Office.

Born in 1959 in Tonekabon, formerly Shahsavar, a city located on the shore of the Caspian Sea, 257km north of Tehran, Fazeli received his education in mechanics from both the Iran University of Science and Technology and the Sharif University of Technology in Tehran,[261] where he was also a religious student activist. He is currently a member of the educational staff at the non-civilian Malek Ashtar University and is a martial senior – just as were his predecessors Taghipour and Forghani. Prior to taking charge at ISA, in February 2009 he was appointed to head the Aerospace Research Institute of Iran.

A comprehensive statute confirming the annexation of ISA by the Presidential Institution was necessary. Its transfer to the Presidential Institution was confirmed by the approval of the Iranian Administrational Supreme Council on September 29, 2010. The third meeting of the Supreme Space Council (SSC) was held on March 5, 2011 and was chaired by the President of IR Iran. Also present were the Minister of Defense and Armed Forces Logistics, the Minister of Communications and Information Technology, the Minister of Science, Research and Technology, the Minister of Foreign Affairs and of course the ISA president. The first SSC meeting had taken place on July 19, 2005, after the approval of the ISA statute on June 11, 2005 and was chaired by Seyyed Muhammad Khatami, at that time the state president. The second SSC meeting was held in July 2006 and was chaired by his

5.6 Hamid Fazeli became the fifth president of the Iranian Space Agency on September 29, 2010 and took office on November 15. [IRNA]

successor, Mahmoud Ahmadinejad. Owing to the ambiguity of its dissolution and revival, an interval of 56 months elapsed before the SSC convened for a third time.[262]

Although it remains legally ambiguous, the annexation of ISA by the Presidential Institution ended its 7-year affiliation to the Ministry of Communications and Information Technology.[263] Its current position is an indication of the significance that the government places on Iran's space endeavor. The agency initiated efforts to paint itself in a new light. Reportedly, it assigns the highest significance to technology development and research in engineering of space systems, including satellites, manned space flights, space probes, space-related sciences, and launch sites. The share for the development of space technology applications and services is more limited than before, and specialized international cooperation as well as space law do not receive the priority they deserve based on global norms. One might dare to say that the agency now intends to be driven by achieving the sustainable development of the country in terms of space technology. Of course this will be expensive and it will therefore be necessary to gain the enthusiastic support of the public.[264] One issue of concern, is that the effort to establish the necessary organizational chart for the agency is being implemented without consulting the available skilled and open-minded advisors and planners. This important task is being carried out by members of staff who are incapable of fully appreciating the issues that they are dealing with.

The fifth ISA president has criticized the way in which his two immediate predecessors ran the agency, stressing that he will support the genuine scientists and experts at the agency and appreciate them. Around a month after the start of his presidency, he

5.7 The fifth and current president of the Iranian Space Agency, Hamid Fazeli (middle), with the first president of the agency, Hassan Shafti (right), who holds the position of advisor to the fifth president. The picture was taken at the 54th Session of the UN Committee on the Peaceful Uses of Outer Space in June 2011 at the United Nations Office at Vienna, Austria. [ISA]

5.8 The hard job of restoring international relations. Mazlan Othman (left), the director of the United Nations Office for Outer Space Affairs, negotiates with Hassan Shafti (right), the first president of the Iranian Space Agency and advisor to the fifth president of the agency, on the margins of the 54th Session of the United Nations Committee on the Peaceful Uses of Outer Space in June 2011 in Vienna, Austria. Also present are Hamid Fazeli (second from left), the fifth president of the Iranian Space Agency, and Ali Asghar Soltanieh (second from the right), the Iranian Ambassador to the United Nations Office at Vienna. [ISA]

celebrated the annexation of the agency to the Presidential Institution and attempted to draw the trust and optimism of the personnel. He himself visited experts and personnel in different sections of the agency, displaying his interest in their work and their concerns. But this promising outlook did not last very long, and the situation became even tougher and messier than before. The security individuals increased their hegemony to the point that the agency is now represented abroad mainly by them and non-civilians. The office for international affairs has become a diplomatic machine that runs in parallel with the Ministry of Foreign Affairs at an inferior level owing to the lack of competence of its representatives in the issues of the space arena.

In addition, following its annexation ISA has seen a great increase in the number of the staff by virtue of attaching new so-called research and engineering institutes. But this has been done in an ill-considered manner. The administrative status of the agency now resembles the allegory of the well-known proverb that 'flies go to leant horses'. This is due to the unlimited and uncontrolled authority that is granted to the agency's top management by the statute of 2008. Apparently, it has imposed a heavy pressure on the agency, with the heaviest load deriving from the entity that is the most futile. The agency is now essentially limited to the role of a financial sponsor for the dummy research and development projects run by the non-civilian and academic sectors, and by the research institutes affiliated to the agency. Consequently, an enormous amount of funding and opportunities are being wasted to no avail without effective control and auditing. It is evidently the result of the turmoil in legislation and administration of the Iranian space endeavor.

6

Research hamstrung by the bureaucracy

Following the annexation of the Iranian Space Agency to Iran's Presidential Institution, efforts started to define a new organizational structure for the agency that was expected to comply with the primary functions of the space agency, namely space technology and applications development. After frequent modifications of the proposed structure, a virtual organizational chart was prepared for approval. It was 'virtual' because the annexation of ISA to the Presidential Institution of the state has not yet been approved. Owing to the disputes between the state and parliament, and the fact that the status of the agency lacks the mandatory legitimacy, any effort to make official changes in the structure and plans of the agency is not legal. As a result, the authorities of the agency proceed in a virtual way to conduct the issues. Whether virtual or real, the aforementioned structural chart assigns the highest significance to technology development under the activity of so-called research on engineering of space systems, including satellites, manned space flights, space probes, space-related sciences, and ground-based launching platforms. The development of space technology applications and services, of specialized international cooperation, and of space law have all failed to receive their due priority. At first glance, it is hardly evident that the agency is operating in line with the demands and requirements initiated by the necessities of the sustainable development of the country and the nation. The big point is that the proposed set-up reveals the explicit ignorance of the authorities of the agency of the need for research and development in space science and technology applications. To pursue the development of space technology without regard for social needs in the rapid national development and the leap towards the goals designated by the development plans would incur tremendous expense without the support and optimism of the nation.[265] It is apparent that the organizational chart of the agency was implemented without the expertise and consultation of skilled and open-minded advisors and planners, and instead was devised mainly by staff seeking to advance their own interests. The origin of this discrepancy is the unrealistic and non-comprehensive vision held by those staff and worse, the compliance made by the top decision-makers of the agency. Moreover, it should be pointed out that although the topics of research and engineering are completely different things, the current authorities of the agency falsely believe them to be mixed and coinciding issues.

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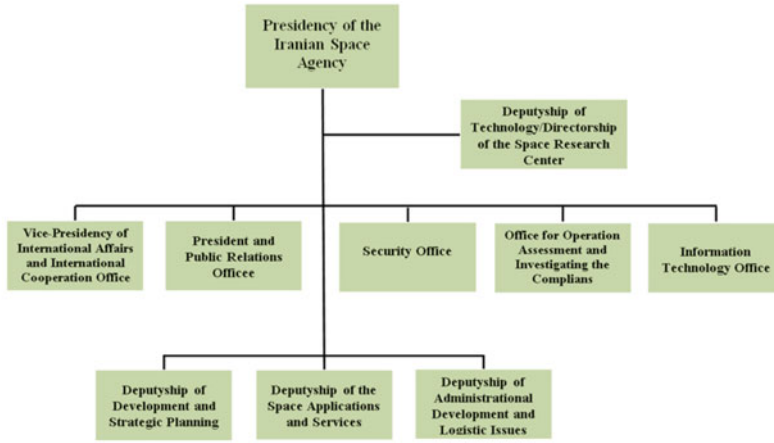

Presidency of the Iranian Space Agency
Deputyship of Technology/Directorship of the Space Research Center
Vice-Presidency of International Affairs and International Cooperation Office
President and Public Relations Officee
Security Office
Office for Operation Assessment and Investigating the Complians
Information Technology Office
Deputyship of Development and Strategic Planning
Deputyship of the Space Applications and Services
Deputyship of Administrational Development and Logistic Issues

6.1 The virtual organizational chart of the Iranian Space Agency. [Author, using data from ISA's website and other publicly available information and reports]

In order to attain its goals, the Iranian Space Agency must benefit from the results of research in a variety of topics related to space science and technology and the projects that the agency is currently pursuing or plans to implement in the future. The strategy, based on the authorizations offered to the agency and its president, in particular in its statute of 2008, was for ISA to establish and develop space research institutes or annex existing institutes which were active under other organizations and entities in the agency. In this connection, following the approval of the second statute in July 2008, the agency hosted the Space Research Institute (SRI). However, because of the flaws, misinterpretations and lack of sufficient control tools provisioned in the last statute, the efforts in this connection have gone astray considerably.[266]

Since the annexation of the Iranian Space Agency to the Presidential Institution, and following the approval of the Council for Development of Higher Education affiliated with the Ministry of Science, Research and Technology, some research institutes have joined together to form a new research entity, called the Space Research Center of Iran, to work under ISA. The Space Research Center of Iran is comprised of seven research institutes, each consisting of several research groups, plus an individual research group on space law as follows:

I Space Transportation Systems Research Institute

- Space Transportation Systems Engineering Research Group
- Space Propulsion Research Group
- Retrievable Carriers Research Group
- Space Operations Research Group

6.2 The main building of the Space Research Center of Iran in downtown Tehran. [International Occultation Timing Association - Middle East (IOTA-ME)]

II Satellite Systems Research Institute

- Satellite Systems Engineering Research Group
- Space Technology Research Group
- Ground Technology Research Group
- Space Robotics Research Group

III Astronautics Research Institute

- Astronautical Systems Engineering Research Group
- Spacecraft Design Research Group
- Space Science Research Group
- Life in Space Research Group

IV Shiraz Mechanics Research Institute

- Astronaut Equipment Research Group
- Space Sensors Research Group
- Aero-thermodynamics Research Group

V Isfahan Material and Energy Research Institute

- Energy Generators Research Group
- New Alloys and Material Research Group
- Energy Storage Research Group

VI Tabriz Space Propellants Research Institute

- Electronic Propellants Research Group
- Operators Research Group
- Mechanisms Research Group

VII Mazandaran Space Research Institute (MSRI) based in Tonekabon

- Remote Sensing Regional Studies Research Group
- Education and International Relations Group
- Space Observations and Exploration Research Group

VIII Space Law Research Group.

It is evident that the functions and structure of the work of the Space Research Center of Iran are based solely on space technology development; there is no research for developing applications. One possible explanation for this is the nature of the research institutes that were drawn together to create the Space Research Center of Iran. An awareness of the structure and background of these so-called research bodies sheds light on the configuration and aims of those institutes and reveals the cause of the discrepancy in this connection. In practice, three main so-called research institutes joined together to form the new research center: the Space Research Institute (SRI), the Aerospace Research Institute (ARI) and the Engineering Research Institute (ERI). Their fields of activities will be explored below. It is worth noting that these institutes are openly non-uniform bodies, each of which serves a specific purpose in the organization of origin. Their unbalanced quality level is also noteworthy and is a great barrier in their integration. ARI was established in the Ministry of Science, Research and Technology; SRI developed in the Ministry of Communications and Information Technology; and ERI was formed in the Ministry of Jihad of Agriculture. They are all primarily engineering organizations, rather than research institutes. In the structure of the Space Research Center of Iran only the Mazandaran Space Research Institute is a new entity, although it exists virtually. Reportedly its site will be at Tonekabon in Mazandaran Province. Although its aims are provisionally remote sensing studies as well as space observations and astronomy, the institute is expected to employ its staff in other disciplines including physics, electronics, aerospace, and mechanical and computer engineering. About US $2 million has been allocated over a period of 24 months to establish and operate the plan of the Mazandaran Space Research Institute. It will be involved with research issues on new space science and technologies and space science and applications.[267]

6-1 SPACE RESEARCH INSTITUTE (SRI)

Based on the authorization of the Council for Higher Education Development, SRI was established on October 21, 2007 to comply with the research requirements of the country in space technologies. It is possible that no one presently in SRI knows who the main contributors to its establishment were. The fact is that none of the people involved in establishing SRI are now attending it, therefore it is unable to benefit from their efforts and

inputs. The idea to establish SRI was initiated by the first president of ISA. However, authorizing its establishment officially prolonged the period in office of the second president.

The objectives for establishing SRI included, (1) conducting mission-oriented activities in the development of space research and accessing modern space science and technology to turn it into a pioneering space research institute; (2) providing the appropriate facilities for the advancement of relevant research activities; and (3) commercializing the outcomes of space research.[268]

The missions provisioned for SRI were as follows:

- Studying and identifying the research requirements to launch and transfer space technologies.
- Performing basic, applied and developmental research projects for realizing the objectives of the Institute.
- Providing required facilities and possibilities for relevant research activities.
- Conducting research cooperation with universities, research institutes, governmental and non-governmental scientific and industrial active centers in and out of the country to improve the quality of research activities in space science and technology in line with the general national policies, taking into account the related regulations.
- Marketing the scientific and research outcomes of the Institute based on related rules and regulations.
- Publishing journals, scientific books and tutorial pamphlets as well as writing computer programs in line with the objectives of the institute based on related rules and regulations.
- Organizing scientific symposia and presenting the outcomes of its research through workshops based on related rules and regulations.

Situated in Tehran, the SRI's directorate was comprised of a Board of Trustees, the director of the Institute, and a Research Council. SRI was expected to become one of the active centers for designing, manufacturing and testing satellite projects in the country. The Institute is currently involved in some remote sensing and telecommunication satellite projects:

- *Zohreh Satellite Project* to manufacture a satellite to meet the country's telecommunications needs of the 1970s. It was to have been Iran's first satellite,[269] but the project is reportedly suspended.
- *Mesbah-2 Satellite Project* to continue the Mesbah Project[270] with the aim of indigenously designing, manufacturing and testing satellites.[271]
- *Pars-2 Satellite Project* to design, manufacture and launch an advanced medium resolution and stereo-imaging multi-spectral remote sensing satellite in order to address the increasing needs of the community of remote sensing users in and out of the country.[272]

The current staff of over 200 employees at SRI are mainly assigned to the Zohreh and Mesbah satellite projects, which were formerly active for many years in the Ministry of Communications and Information Technology and the Iranian Research Organization for

Science and Technology (IROST) affiliated to the Ministry of Science, Research and Technology, respectively. However, despite their administrative background and records, these people are lacking the practical experience and expertise because of poor access to qualified and experienced researchers, tutors, sources and more importantly clear-thinking managers.

Following the approval by the Iranian Administrational Supreme Council on September 29, 2010 of the annexation of ISA to the Presidential Institution, two other research institutes have joined the space agency: the Aerospace Research Institute and the Engineering Research Institute.

6-2 AEROSPACE RESEARCH INSTITUTE (ARI)

Founded in 2000 under the Ministry of Science, Research and Technology, ARI was an academic organization with the following aims:

- Recognition and introduction of aerospace technologies, and cooperation with related organizations and entities for acquisition of the latest aerospace technologies.
- Development and expansion of research in the aerospace field attempting to meet the country's research demands.
- Cooperation with research and educational organizations in the country with the aim of improving the quality of related research activities.

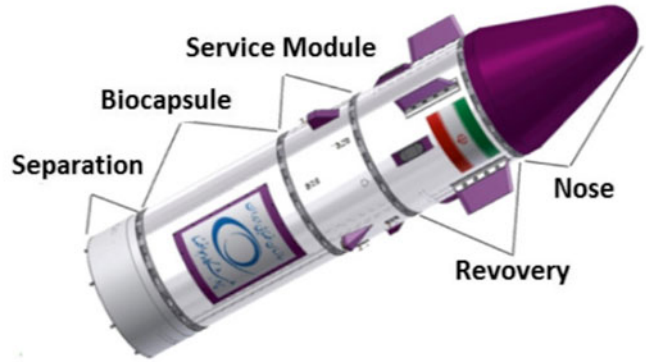
The Institute was mandated to create an environment conducive for research and provide requisite research facilities, namely a parallel processing laboratory, an electronics laboratory, a virtual reality laboratory, an Information Technology Center, a library, and construction and assembly plants.[273] It has been actively involved in aerospace research at the national level, as well as in establishing links and working relationships with appropriate industries. The organization included departments for Aeronautical Sciences and Technology, Space Science and Technology, Aerospace Law, Standards and Management, Aerospace Physiology Research Group, and a Strategic Aerospace Studies and Future Planning Think Tank. The principal objectives were to identify and introduce state-of-the-art aerospace and related technologies, and to collaborate with organizations in conducting innovative research. It was involved in research and analysis of booster rockets, reentry vehicles, rocket engines, and payloads, plus aerospace-related topics such as life support in space. However, it mainly focused on the aerodynamic design and analysis of launch vehicles. In this regard, it was capable of estimating aerodynamic coefficients and determining flow patterns around launchers with levels of accuracy appropriate to the different phases of a design process. Planning and conducting wind tunnel test for validation of analytical and numerical results was also among the Institute's capabilities. It also dealt with sub-orbital sounding rockets and their payloads. ARI carried out several study programs in the capabilities and applications of sounding rockets, their payloads and experiments. The Department of Aerospace Law, Standards and Management at ARI conducted studies of orbital debris. A variety of subjects such as categorization, characteristics, tracking, and laws on orbital debris were worked out there. Mathematical simulation and collision probability functions and hazard analysis were studied.

In 2008, ARI employed some 65 researchers, 33 organizational members, and 13 PhD fellowship students to study in-country and abroad. It carried out several research projects in collaboration with industry. The aerospace industries of Iran are important contractors of ARI, for which it has carried out a number of space-related tasks. One, the space lab project and life in space involved designing and prototyping the Kavoshgar rocket payload. Another project, funded by the Aerospace Industries Organization, was an evaluation of the standards utilized in designing, manufacturing and testing of aerospace systems. Some other space-related projects were: studies on propulsion fundamentals and performance of microsatellites propulsion systems; software for satellite dynamics; studies on the cooperation of private companies in space activities such as space commercialization and space tourism; effects of microgravity on bone health of astronauts; analysis and investigation of satellite navigation systems and devising strategies for developments in this area.[274] In line with its research and knowledge promotion tasks, ARI has published a variety of papers, reports, books and bulletins, including a series of books on subjects such as space debris, and medicine and space physiology. This output includes around 182 papers that reflect the results of the research achievements of the Institute, 541 reports on research plans and activities, over 25 specialized aerospace books and journals, as well as about 100 issues of aerospace bulletins. Its specialized Persian-language aerospace publication is the quarterly *Journal of Space Science and Technology* (*JSST*). Moreover, ARI hosted the Permanent Committee on Space Radiations (PCSR) established to justify the country's major policies on space radiation in relation with aerospace research activities. Its objectives were to familiarize researchers working in different fields with the destructive space radiations present in the space environment and to undertake policy-making for scientific and strategic goals. Three working groups were active under PCSR, involved in the identification, measurement, detection, estimation of the effects, and means of protecting against space radiation.[275]

On joining ISA subsequent to the annexation of the space agency to the Presidential Institution, the Aerospace Research Institute was renamed the Astronautics Research Institute (ARI), but its functions remained the same as before.

6-2-1 Research of verifying the possibility of life in space

Based on plans for Iran to send a human into space by 2021, a task which has been assigned a high priority, an extensive effort has been launched by the Astronautics Research Institute. In particular, ARI is implementing a project to develop the bio-capsule for such a spacecraft. This will provide a safe enclosure for living creatures in the harsh and hazardous environment of space. Without such technological support, terrestrial life cannot survive in outer space. By definition, space starts at an altitude of 100km. There is no air to breathe, cosmic radiation is an ever present threat, the familiar force of gravity is absent, and the effects of long term exposure to this environment have yet to be determined. By implementing the bio-capsule project, Iran intends to investigate the possibility and quality of life in space, and then apply its findings to send into space and safely retrieve a human.



6.3 The scheme of the Kavoshgar Pishgam payload. [Reza Kalantari-Nejad: 'The Pioneer Mission of the Kavoshgar', Presentation by the Delegation member of the IR Iran to the 50th Scientific and Technical Subcommittee Meeting of the Committee on the Peaceful Uses of Outer Space (COPUOS), February 11-22, 2013, Vienna, Austria]

Table 6.1. The precedent of the Kavoshgar Project and its missions. [(1) Reza Kalantari-Nejad: 'The Pioneer Mission of the Kavoshgar', Presentation by the Delegation member of the IR Iran to the 50th Scientific and Technical Subcommittee Meeting of the Committee on the Peaceful Uses of Outer Space (COPUOS), February 11-22, 2013, Vienna, Austria; (2) Author].

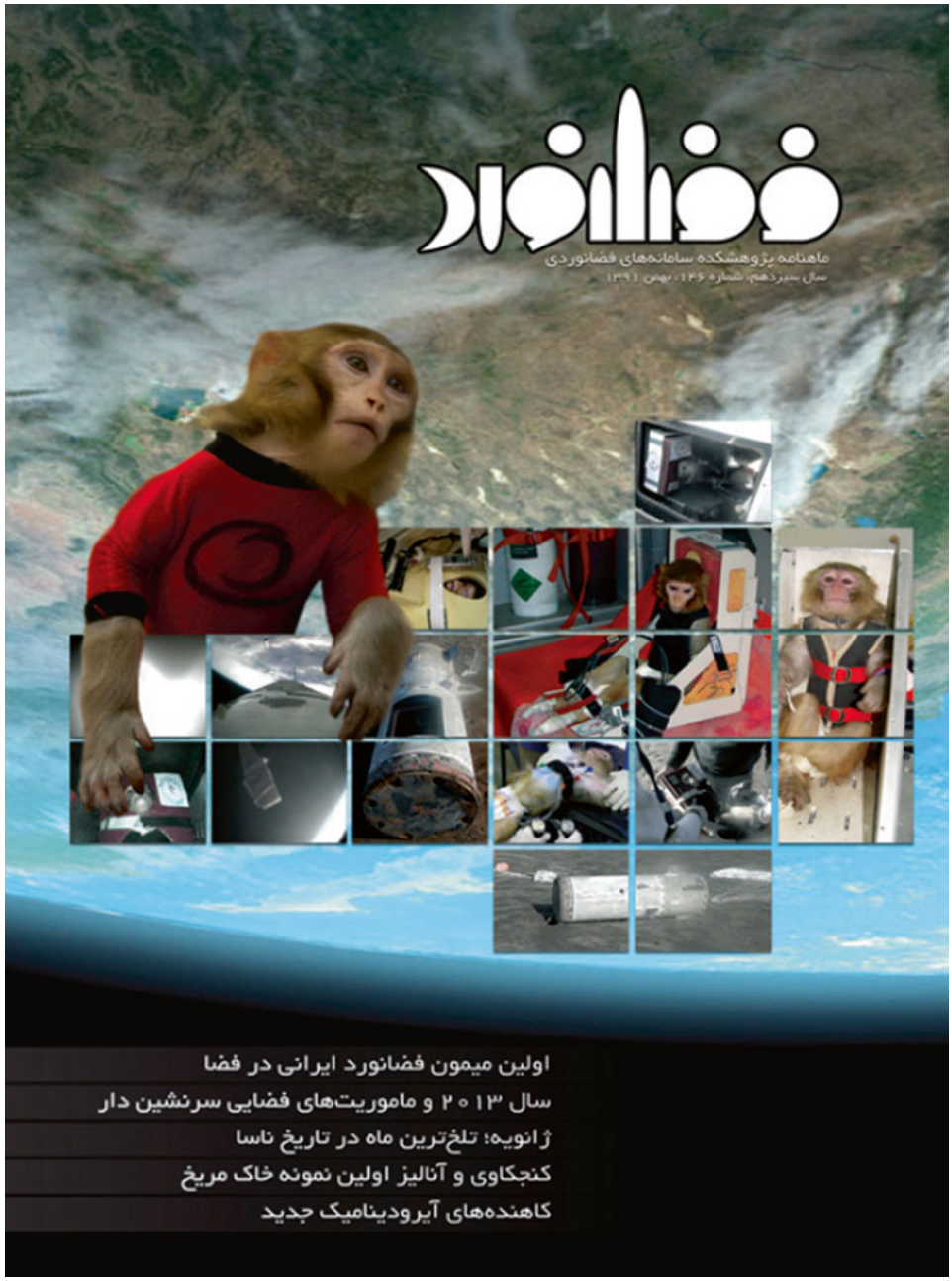
Name	*Mission*	*Altitude (km)*	*Launch date*	*Result*
Kavoshgar Class B (III)	Primary bio-space research	55	February 2010	Successfully retrieved
Kavoshgar Class C (IV)	Bio-capsule test and payload retrieve	135	March 2011	Successful retrieve of the payload
Kavoshgar Class C (V)	Living cargo retrieve	120	September 2011	Mission failure and torment and death of the astronaut monkey
Kavoshgar Class C (Pishgam)	Launch of Pishgam into space (sub-orbital)	120	January 2013	First Iranian astronaut monkey reaches outer space

Ordinarily a bio-capsule will incorporate a number of life support systems for eliminating carbon dioxide, producing oxygen, shielding against solar radiation, and maintaining a specific temperature range inside the capsule. Depending on the mission, for long term presence in space the spacecraft is equipped with systems for securing water and food, sleep and relaxation, and management of human waste. All these systems should be able to work reliably. In addition to the equipment for confronting the harsh space condition, the mechanical vibrations and impacts during the flight pose threats to the inhabitants of a capsule. Mechanisms similar to the suspension system of a terrestrial vehicle will be installed in the seat in order to minimize the vibration and shock energy. Another important part of a bio-capsule is applying the tools for monitoring the safety of the living

6.4 The start of the 20-minute sub-orbital flight of the Kavoshgar Pishgam bio-capsule to an altitude of 120km on January 29, 2013. The passenger was a three-year-old Rhesus monkey named Aftab (Sunlight). Inset images at the top left show the status of the capsule's inhabitant and other parts. [ARI]

passenger, whether this be a human or another living creature. The health monitoring system is comprised of tools for measuring breathing rate, heart rate, the deep and surface body temperatures, as well as electrocardiograms and electroencephalograms. In addition, environmental sensors and monitoring devices in the capsule will ensure the proper performance of the life support systems by measuring the percentage of gases such as carbon dioxide, carbon monoxide and oxygen. Moreover, the temperature, pressure and humidity of the capsule will be measured, as well as the mechanical vibrations imposed upon it. The mass of the spacecraft is also important, since a more complex spacecraft will likely be heavier and require more energy to escape the gravity of the Earth, which will in turn require a stronger and more powerful launch vehicle.

Based on its functions and duties, the Life in Space Research Group of ARI has been studying the topic of life in space since 2002. Following the decision by the top authorities that Iran should send a human into space, ARI joined with the Iran Aerospace Industries Organization (IAIO) of MODAFL to develop bio-capsules for sending a living cargo into space and performing the appropriate tests.[276] As the first step, in February 2010 the Kavoshgar (Explorer) Project sent one rodent, two turtles, and several worms to an altitude of 55km on a sub-orbital flight and retrieved them alive. In March 2011 the team launched the Kavoshgar-4 rocket to an altitude of 135km carrying a test capsule designed to carry a monkey, although in this instance unoccupied. On the third attempt, Kavoshgar-5 carrying a live monkey was launched for a 20-minute sub-orbital flight in September 2011 leading to failure of the mission and the death of the monkey. The Pishgam bio-capsule carried by the Kavoshgar rocket reached an altitude of 120km in January 2013 carrying a 3-year-old Rhesus monkey.[277] The capsule weighing around 60kg was capable of accommodating a 2.5 to 4kg monkey and providing suitable conditions for its life, with monitoring, during the 20-minute sub-orbital mission. In this capsule an absorbent which could absorb 90%



6.5 The astronaut monkey of Iran, Aftab, on the cover of the Astronautics Research Institute's newly published magazine *Fazanavard* (Astronaut). Under the Kavoshgar Project, the bio-capsule accommodating the 3-year-old Rhesus monkey reached an altitude of 120km during a 20-minute sub-orbital flight on January 29, 2013. [ARI]

of the unwanted vibration energy was mounted under the seat in order to minimize the sense of discomfort. The system for eliminating carbon dioxide and producing oxygen was capable of keeping the amount of these gases inside the capsule at the desired level for a continuous 5 hours using a chemical technique. The gas pressure inside the capsule was secured by a specific method of sealing of the capsule. The capsule was equipped with a set of sensors to monitor the health status of the living inhabitant, which included surface temperature, body temperature and heart rate. All of this information was processed in the central system of the capsule and then sent to the ground station by radio. As a result, researchers were able to monitor the functional performance of the capsule during the flight.[278]

The successful Pishgam mission was the result of precise and coordinated operations by different subsets including bio-capsule, retrieving sub-system, separation sub-system, navigation sub-system, services sub-system, data and image telemetry sub-system, aerodynamics and aerodynamic heating, rocket engine, launcher and ground stations – all of which were designed and produced in line with available knowledge in the framework of the Plan of Space Laboratory and considering the standards of the space systems engineering and highest reliability provided by the specialists and engineers of the Astronautics Research Institute of ISA.[279]

The exploratory aspects of the project focused on assessing the effects of flight on the physiology of living creatures, assessing aerodynamic heating, understanding the aerodynamics and dynamics of reentering the atmosphere, and assessing the effectiveness of insulators and heat shields on a payload. The functional aspects of the project were a step toward the materialization of manned space flights, providing an intellectual payload capable of self-monitoring, and performing a wide field operation and providing logistic services.[280]

6-3 ENGINEERING RESEARCH INSTITUTE (ERI)

The Agricultural Engineering Research Institute (AERI) was established in 1983 under the Ministry of Jihad of Agriculture but changed its name to the Engineering Research Institute upon joining ISA in September 2010. Considering the duties and functions of the Ministry of Jihad of Agriculture, the objectives of the Institute were conducting research on different aspects of agricultural engineering. ERI was conducting its activities in three groups of control, material and chemical engineering at its headquarters near Tehran. The first provincial branch, the Isfahan Engineering Research Institute (IERI) was established in 1985 in Isfahan, and the second provincial branch, the Fars Engineering Research Institute (FERI), was established in 1986 in Shiraz. FERI was an engineering and research center devoted to research and design of process systems for dairy, food and related industries, and within a short period it designed, manufactured and commissioned more than 100 projects in various fields of dairy, starch, food and biotechnology. The third provincial branch, the East Azerbaijan Engineering Research Institute (EAERI) was started in 1987 in Tabriz. The wide variety of products made by ERI included irrigation and drainage facilities, agricultural machinery, food and post-harvest products, and research and technical services. The main ERI laboratories that played a key role in the research were the

Metallurgy Laboratory and the Chemistry and Polymer Laboratory. The Metallurgy Laboratory was involved in mechanical properties, metallographic, quantometric and non-explosive experiments. The Chemistry and Polymer Laboratory, which was established in 1986, was involved in the analysis and identification of chemicals, plastics, foams, adherents, color and resins, composites and their quality control. In 2012 the number of staff working in ERI and its three provincial branches exceeded 1,200.[281]

Because of its previous affiliation with the Ministry of Jihad of Agriculture, ERI was very much supported by the President of the state and other top authorities, and one of the conditions set by the president of the state for annexing ISA to the Presidential Institution was reportedly the inclusion of ERI in the organization of ISA. As an amazing justification for this, the president of ISA announced that the ERI would be involved in processing and providing the food for astronauts.[282]

The annexation to the Presidential Institution has had the unfavorable effect on ISA of adding a large number of mostly unqualified staff. Before the annexation, the staff and personnel of the agency were around 250 people. It grew almost overnight to 1,700, with the majority of the incomers being inefficient and inexperienced, particularly those from ERI.

6-4 A QUEER AND ILL-SHAPED CONFIGURATION FOR RESEARCH

The research institutes that joined with ISA need legislative approval of the annexation of ISA to the Presidential Institution in order to legitimately conduct and implement their functions under the space agency. In spite of the fact that the ambitions of the space agency in fulfilling the research activities are plausible, there are fundamental and deep gaps between the capabilities of its research institutes and the actual requirements. This is because the institutes were originally established under ministries with different aims, policies, and managerial orientations. Five years since its establishment, SRI is still lacking appropriate published material and documentation to reflect its achievements. It is the same with ERI, which only published a bulletin called the *Modern Agricultural Technologies* from 1985 to 1988 as its news periodical. It is barely an indication of the indigence of the genuine research activities in those self-styled research institutes. Despite their having been established for some time, research is not yet institutionalized in SRI and ERI. The situation is a little bit different in the case of ARI. The revision in employing top and qualified specialized human resources in the institutes is vital. The traditional configuration and structure of the institutes needs informed and actual revision to be consistent with the research needs of ISA and the country in space science and technology, particularly from the viewpoint of applications development, which is unjustly disfavored. ERI was not a space research institute, and with a large number of staff, around 70% of all the personnel at ISA, it is in need of serious reorganization in terms of structure, human resources and management if it is to be capable of making real progress in complying with the demands and requirement of ISA for space research.[283]

As the backgrounds and itineraries of the abovementioned institutes show, they were engineering institutes and not research institutes. They were developed mainly for engineering purposes and not for scientific and research means, and as a result it is incorrect to refer to them as research institutes. The physical research institutes are the most

appropriate place for research on aerospace and space science and technology. Although ERI changed its name, it was barely an engineering institute under the Ministry of Jihad of Agriculture, because it lacked any experience in research and had no staff or equipment to pursue such work. The record of its activities explicitly shows this. The Space Research Institute has not yet attained the status to live up to its name. Only the Aerospace Research Institute has relevant experience of research issues and activities because it was established under the Ministry of Science, Research and Technology and has tried to work by the obligations and mandates of valid research standards.

Without exception, in the three research administrations of ISA there are many newly employed young and freshly graduated self-styled researchers and engineers who lack expertise and competence in scientific and research work. The reason for this is that they were not bred and trained for research work owing to the basic flaws and obstacles predominating in the educational, academic sector, and managerial visions that are unable to give priority to knowledge and research-based and exploration-based understanding. Scientific and research eligibilities and merits are not the principal priorities for entering and working in the space research institutes; a person's origin and amity relationships are the vital factors in securing employment at the institutes. The rapid changes in the status and position of ISA in the last few years have also affected its institutes. There has been an increase in the penetration of members of the martial entities in the decision-making and operational levels of these institutes and ISA as well.[284]

All three research institutes that joined with ISA need concentrated policy-making in conformity with the needs and requirements of the agency. This could be achieved under the supervision of some Supreme Space Council (SSC), as in the past, but its legitimacy would depend on the endorsement of parliament to authorize the annexation of ISA to the Presidential Institution and approve a new statute for the agency under which the SSC would play this key role.[285]

Furthermore, the topic of research – or the activity to which is given the name of research – at ISA is indeed a grotesque and disharmonious entity, and the thing that is unclear and ambiguous is what is expected from it. It is a false tradition in Iran that, for example, a tutor or anyone presenting lectures at a university is referred to as a professor simply out of respect, irrespective of whether that person has the qualifications and accomplishments of a university professor recognized by global standards. The same is true for research. Anyone who holds a master's degree or higher in any career is considered a researcher and is recognized officially and included in official statistics. Consequently, based on the number of holders of a master's degree and higher in Iran the country has researchers. These people are judged to be qualified to work in an institution whose function is research or scientific work. But having research abilities, expertise, and experience of vital importance for doing genuine scientific research is *not* a major prerequisite. Just as with any other research institute in Iran, this was how the research staff were recruited by the research institutes affiliated to the space agency. Because of this unwise norm, it is difficult to attempt to attract genuinely talented researchers to join the staffs of the institutes.

Why have the space research institutes failed to attract space science and technology related elites, especially from the academic sector in Iran? One reason is because of the structure and foundation of the institutes. They are too administrative and stifle the spirit

and mood for research. Secondly, with the passage of time the academic sector is being emptied of the genuine elites and real scientists and researchers who in a variety of ways are isolated, expatriated, retired, banished and are shoved to the margins. Given that the research institutes belonging to ISA are situated in different locations in and around the capital and also in other main cities throughout the country, there is a plan to collect and concentrate the research institutes in a single place in downtown Tehran, regardless of the main and basic site parameters for research work. The site is indeed appropriate for any type of activity *except* for research. Selection of the site is an indication of crudity and inexperience of the decision-makers and in-charge authorities that gave the highest priority to prosperity and welfare seeking, and missed the real intention and serious desire to conduct genuine research there or elsewhere. As a result, there is seen no efficient and favorable outcome from the institutes, even in the form of non-experimental and theoretical results with no appropriate reflection.

6-5 DISFAVORED GENUINE RESEARCH

The official structure of the research institutes of ISA, even in the virtual form, obviously shows that those entities are units for aerospace engineering, and one dare say that they are involved in research. Really the institutes only carry the title of research in order to benefit from the official privileges that this bestows. What is the true position of genuine research at the space agency?

Although astronomical activities have continued for several years and an observatory has been constructed at the Alborz Space Center, there is still no position for astronomy and astronomical activities in the organizational chart of ISA, even though both statutes of 2005 and 2008 place an emphasis on astronomy and its promotion by the agency. The funds for astronomical activities are allocated, but there is no clear policy for this type of activity. The research for the development of applications is even more disfavored. This is due to managerial malfunctions and the corruption in the traditional form of human resources active under the deputyship of the space application and services, particularly in its remote sensing section.

In the following sub-sections the activities in astronomy and the development of applications are given to highlight the contributions of these genuine works and to clarify their deserving positions.

6-5-1 Astronomy and space observations

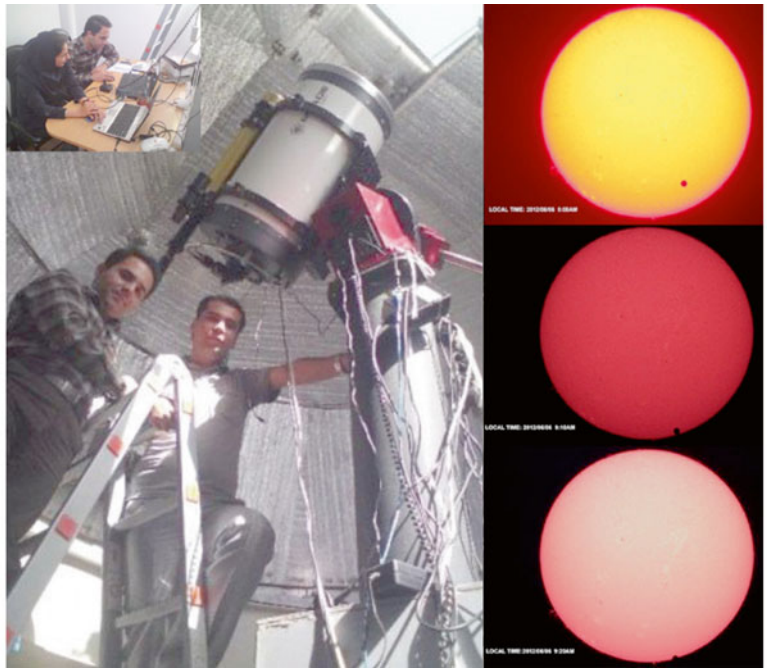
The idea to establish an observatory of the Iranian Space Agency derives from the early days of the agency itself. The statute of ISA mandates that astronomy is one of the topics that the agency should promote, although surprisingly it does not possess a position and structure in the organizational chart that is still virtually in force. This reflects the low priority the authorities have assigned this topic in recent years. Consequently, in the system in which everything is worked out virtually, the position of astronomy is more ambiguous than the others. Nevertheless, astronomy is one of those subjects that struggle to remain alive and progressive. It has been a marginal but a brilliant activity. While it still

misses an administrational identity, astronomy and space observations continue to grow at the agency owing to a group of competent, enthusiastic and young amateur astronomers. The main result of their efforts has been the establishment of an observatory at the Alborz Space Center.

Presently, the observatory of the Iranian Space Agency situated at the Alborz Space Center is a pivotal entity for almost all of the astronomical activities at the agency. Since 2011, the observatory has possessed a Meade LX200GPS 16in Schmidt-Cassegrain telescope that fits the needs of advanced amateurs as well as professionals. The observatory has facilitated a variety of observational research work and has implemented relevant projects. For example, at the international level ISA and the Asia-Pacific Space Cooperation Organization are jointly working to observe Low Earth Orbit (LEO) and Geostationary Orbit (GEO) satellites. And the observatory plans to join the international initiative of observation of Near Earth Objects (NEO) being undertaken by COPUOS member countries and the United Nations Office for Outer Space Affairs.

Moreover, the observatory and the space observation research team of ISA actively cooperate with the Middle East Section of the International Occultation Timing Association (IOTA), which is a non-governmental organization for promoting and facilitating observation of occultations and eclipses. It provides predictions for grazing occultations of stars by the Moon and predictions for the occultation of stars by asteroids and by planets that can produce very useful scientific data. IOTA also provides information on observing equipment and techniques, and shares information about observations by its members. IOTA's objectives include promoting scientific research and discoveries using occultation-related methods. Conducting research at local, regional and international level, publishing results of studies in popular and scientific journals, stimulating public awareness of astronomical phenomena such as solar and lunar eclipses and occultations of stars by minor planets, the Moon and other solar system bodies are other objectives. To this can be added improving lunar profile data through timing of grazing and total occultations, determining shapes and sizes of minor planets and comets through timing of occultations of stars by these objects. Discovering new satellites and companions of minor planets, and confirming the characteristics of previously discovered such objects, are IOTA's goal in the meantime.[286] The space observation research team of ISA routinely holds joint workshops and seminars with IOTA and draws the interest of a considerable number of enthusiastic astronomers and astrophysicists.[287] IOTA-ME, the Middle East branch of IOTA conducts training courses in different cities throughout Iran with the support of ISA. The Third International Conference on Eclipsing and Occultation was held in Tehran on November 1-3, 2012 by IOTA-ME at the Space Research Institute of ISA and was sponsored by ISA and the International Astronomical Union (IAU). This conference held three workshops on Eclipsing Variable Stars, Occultation and Trans Neptunian Objects (TNO), and Exoplanets. Reportedly, 108 people including young astronomers, university students, scholars and other interested people participated in the conference.

In the domain of astronomical research and observations, a handful of projects were carried out by various different groups of young and amateur astronomers headed by experts of astronomy and space observation. As an example, the transit of Venus on June 6, 2012 was one of the observation projects carried out. It was implemented by a group of young astronomers, using the Meade LX200 GPS 16in Schmidt-Cassegrain telescope and a Coronado telescope.



6.6 Observation of the transit of Venus on June 6, 2012 by the Observatory of the Iranian Space Agency at the Alborz Space Center (ASC). A team headed by Afshan Karbasi (left in the inset photo top right), and two other members, Kourosh Rokni (left in the photo) and Atila Poro performed the observation. They used the Observatory's Meade LX200 GPS 16in Schmidt-Cassegrain telescope as well as a Coronado telescope. A sample of the acquired images is seen at right. [ASC & IOTA-ME]

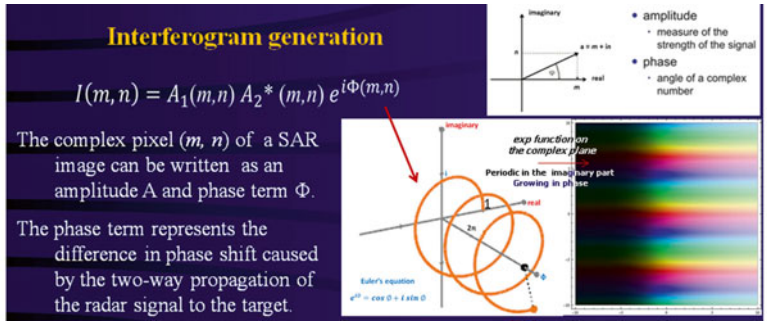
The Academy of IOTA-ME holds its scientific and educational sessions at ISA's Alborz Space Center with the aim of educating and training the participants in methods of predicting, observing, and analyzing occultations, in addition to observing celestial bodies including the Moon and other planets of the solar system, eclipses, galaxies and so on. Moreover, IOTA-ME publishes the monthly *Journal of Occultation and Eclipsing*. In addition to publishing special bulletins on the occasions of a variety of astronomical events, IOTA-ME publishes a monthly *Newsletter*, which reflects the reports of the events related to the activities of the association and other relevant activities. This keeps the members and its supportive body ISA informed of important activities and events in Iran and around the world. Thanks to ISA and IOTA-ME, now many observers across the country are contributing observations of relevant events and Iran has become an important center of occultation activity. This is considered to be a successful exercise by ISA in promoting and popularizing astronomy and space observations throughout the country on an ongoing basis. Nevertheless, there is no definite and clear position for astronomy and space observations in the context of the organizational chart of the agency.

6-5-2 Research for applications development

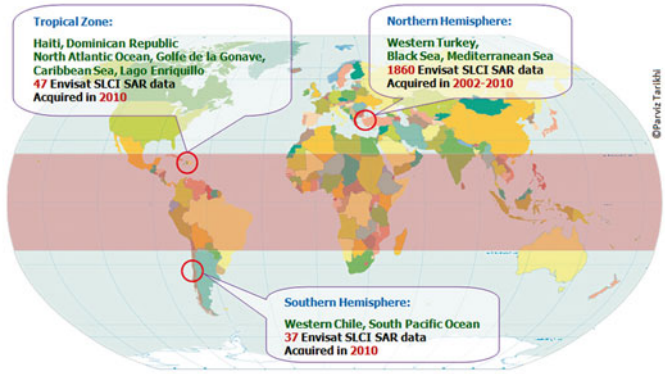
The abovementioned activities like astronomy and space observations should be categorized and dealt with in the domain of research, even though the organization of ISA does not assign them the priority and importance they deserve. Another activity that does not have a specific identity in the organization is research for developing technology applications. For example, although remote sensing and Earth observation activities at ISA are regarded as a space service, there is not a clear interpretation of those domains in terms of how they should be developed in the light of research and become applicable for different local uses and fields.

As said before, the research institutes of ISA are really entities for developing engineering work and only carry the title of research to benefit from its privileges officially. There is no actual place and official opportunity to conduct real and genuine research, neither in technology development nor in the development of space science and technology applications. There is no support from the space agency to carry out genuine research work. This strategy should be revised in the direction of the actual needs and fundamental requirements of the Iranian community and the nation. One example of this disfavor of real research is a small group focusing on the application of microwave remote sensing, particularly the new technique of Synthetic Aperture Radar Interferometry (InSAR). Despite its importance, this research has not been lucky enough to gain a position in the organizational chart of ISA, neither in the research institutes nor in the applications domain. In drawing up the organizational chart, the planners failed to appreciate that research activities in astronomy and applications development should receive the highest priority because they were directly referred to in the statute of the agency with a mandate to pursue their development.

One of the topics in the domain of remote sensing and Earth observation research has been carried out for around 17 years, initially at the former Iranian Remote Sensing Center and later by the Iranian Space Agency. Radar remote sensing is a new Earth observation technology with both promising results to date and future prospects. It is a useful tool for surface mapping,[288] and a good means for gaining a general sense of the topography and geological setting of an area of interest in advance of doing fieldwork. When the InSAR technique is applied time, incidence angle, resolution and coverage area all play an important role in the outcome.[289] Thus SAR Interferometry (InSAR), Differential InSAR (DInSAR), Persistent Scatterer InSAR (PS InSAR), and Distributed Scatterer InSAR (DS InSAR) are the newly emerging techniques in radar remote sensing.[290] Consequently, InSAR is a sophisticated radar remote sensing technique for combining synthetic aperture radar single-look complex images (SLCI) to produce an interferogram and utilizing its phase contribution to land topography, surface movement, and target velocity. In recent years considerable applications of InSAR techniques have been developed. It is an established technique for precise assessment of land surface movements, and generating high quality digital elevation models (DEM) from space-borne and airborne data. InSAR is able to produce DEMs with the precision of several tens of meters whereas its movement map results are of sub-centimeter precision.[291] The technique has many applications in the


Interferogram generation
$I(m,n) = A_1(m,n)\, A_2{}^*(m,n)\, e^{i\Phi(m,n)}$
The complex pixel (m, n) of a SAR image can be written as an amplitude A and phase term Φ.
The phase term represents the difference in phase shift caused by the two-way propagation of the radar signal to the target.
imaginary
real
amplitude
measure of the strength of the signal
phase
angle of a complex number
exp function on the complex plane
Periodic in the imaginary part
Growing in phase
Euler's equation

6.7 The concept of generating an interferogram. [Author]

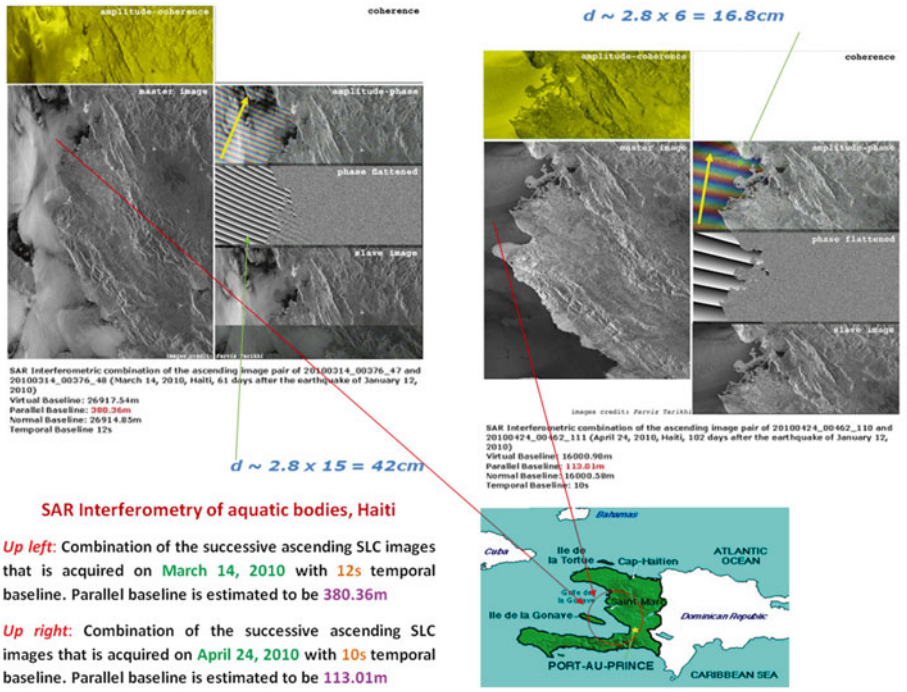


6.8 The study areas of the project C1P.8242 includes Haiti, Dominican Republic, Western Chile and Western Turkey coastal areas and inland lakes. [Author]

Earth sciences such as topographic mapping, environmental modeling, rainfall-runoff studies, landslide hazard zonation, and modeling of seismic sources.[292]

There is also a new use of InSAR for aquatic bodies.[293] Observations by a small study group led by the author have shown that using SAR interferometry technique with a maximum temporal baseline of 16sec for image pairs, it is possible to effectively study sea surface disturbance. In continuation of the exploratory work of using InSAR on marine areas in different locations, the 1.5-year project C1P.8242 under the European Space Agency affiliated European Space Research Institute (ESRIN) was started in February 2011 by the Microwave Remote Sensing Group. ESRIN secured the data required for the project, which was performed at Haiti, Dominican Republic, Western Chile and Western Turkey coast areas and inland lakes.

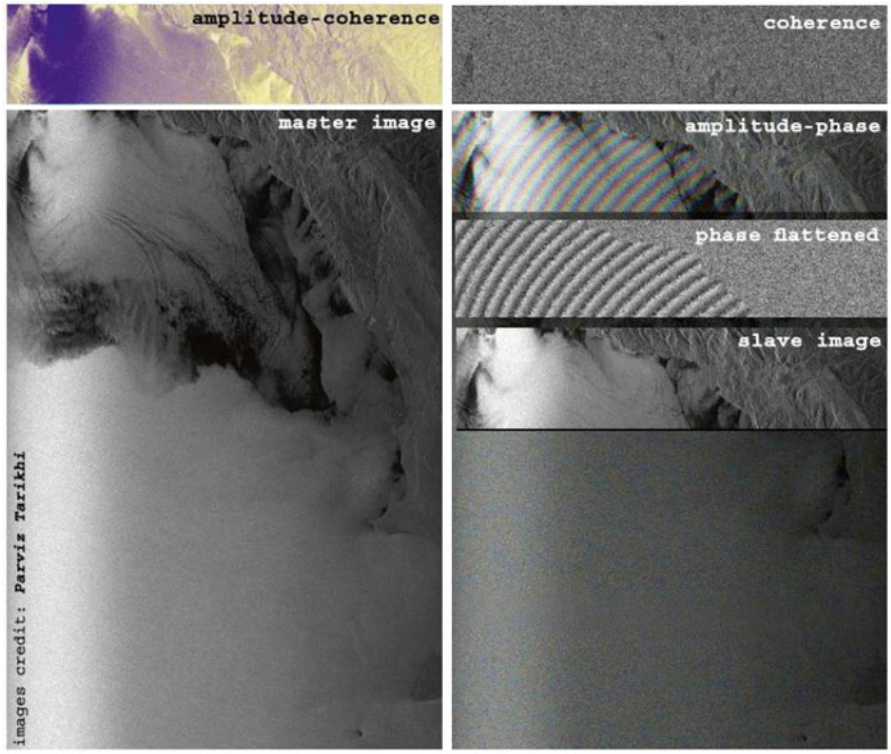
Common image processing and combination techniques used in SAR interferometry were applied. The successful use of InSAR for aquatic bodies requires comparison of the SLCI pairs with very short temporal baselines. In the case of SLCI from ENVISAT the temporal baseline should range between 8 and 16sec because of the technology that is used by its synthetic aperture radar system. Using InSAR techniques for aquatic bodies in


amplitude-coherence
coherence
master image
amplitude-phase
phase flattened
slave image
SAR Interferometric combination of the ascending image pair of 20100314_00376_47 and 20100314_00376_48 (March 14, 2010, Haiti, 61 days after the earthquake of January 12, 2010)
Virtual Baseline: 26917.54m
Parallel Baseline: 380.36m
Normal Baseline: 26914.85m
Temporal Baseline 12s
d ~ 2.8 x 15 = 42cm
d ~ 2.8 x 6 = 16.8cm
SAR Interferometric combination of the ascending image pair of 20100424_00462_110 and 20100424_00462_111 (April 24, 2010, Haiti, 102 days after the earthquake of January 12, 2010)
Virtual Baseline: 16000.90m
Parallel Baseline: 113.01m
Normal Baseline: 16000.58m
Temporal Baseline: 10s
SAR Interferometry of aquatic bodies, Haiti
Up left: Combination of the successive ascending SLC images that is acquired on March 14, 2010 with 12s temporal baseline. Parallel baseline is estimated to be 380.36m
Up right: Combination of the successive ascending SLC images that is acquired on April 24, 2010 with 10s temporal baseline. Parallel baseline is estimated to be 113.01m
Bahamas
Cuba
Ile de la Tortue
Cap-Haitien
ATLANTIC OCEAN
Ile de la Gonave
Dominican Republic
PORT-AU-PRINCE
CARIBBEAN SEA

6.9 Application of InSAR for marine bodies (Liqui-InSAR) at the Western Haiti coastal zone. [Author]

coastal areas and inland lakes looks promising when applied to image pairs that have temporal baselines shorter than 16sec (for reasons that can be explained by the theory of interferometry of optical surfaces).[294]

Although using this technique provides the possibility of instantaneous estimation, it indicates the sea surface disturbance and could be used for synoptic monitoring and management of coastal zones. There could be other potential benefits that need to be further investigated and studied. By increasing the coverage area of the successive SAR images, access to the information about the behavior of the seawater disturbance in larger extents would be possible. A suggestion that lies at the core idea of the project could be a system similar to NASA's STS-99 mission in which two SAR antennas with 60m separation collected data for the Shuttle Radar Topography Mission (SRTM). However, the imaging procedure by two antennas can be carried out with a small delay ranging between 8 and 15 seconds, and it could be regarded as a single-pass InSAR with a slight time baseline in the range of 10sec or a bit more. This concept can be described as short temporal baseline SAR interferometry (STBInSAR). The idea needs to be examined and tested for various cases and different locations, and for different wavelengths in the L-band and X-band, in addition to the C-band. Using single-pass InSAR, data for the same area from different view angles can be acquired. The temporal and perpendicular baselines then tend to zero or remain constant. As a result only the parallel baseline component remains, and it would facilitate precise assessments of the aquatic body displacement and its direction.



6.10 Application of InSAR for marine bodies (Liqui-InSAR) at the South-Western Haiti coastal zone. [Author]

6.11 The author giving a presentation entitled 'Using Space-borne SAR Interferometry Technique for Eastern Mediterranean Sea Shores' at the 22nd Workshop on Space Technologies Applied to the Needs of Humanity: Experience from Cases in the Mediterranean Area, which was jointly organized by the UN-OOSA and International Astronautical Federation (IAF) September 28-30, 2012 in Naples, Italy, and the 63rd International Astronautical Congress, immediately after the workshop of October 1-5, also in Naples, Italy. [Zohreh Tebyani]

Although the research work carried out has hardly drawn the attention of the authorities in ISA, it has raised a considerable discussion amongst scientists and experts abroad. ESRIN considered it to be a potential InSAR application that deserves further research, and secured data to enable the author to continue. A reviewer from the International Society for Photogrammetry and Remote Sensing, who assessed the relevant paper prepared by the author, commented that the topic was very interesting and deserved to be discussed by InSAR specialists with specific focus on understanding and interpreting the ocean signature and the effectiveness of this technique for oceanography or Earth observation. On the other hand, a reviewer of the *Advances in Space Research Journal* states that the idea of using the SLCI pairs with such a small temporal baseline cannot be correct, and the phase differences between the two SLCIs that are found must be artifacts of the SAR processing of the two frames. The reviewer suggested that this phenomena, that seems to occur over water only and not over land in the produced images, might be due to the co-registration method used for the generation of the interferograms and the fact that the Doppler centroid estimates are less accurate over water than over land; so there may be bigger differences between the complex pixel values over water than over land. This remains to be determined. The reviewer assures that these phase differences do not contain any useful geophysical information and could be just an artifact of the SAR processing and data analysis method. However, the assessment of the reviewer is not entirely satisfying and fails to cover all the facts. The results in some areas are supported by other evidence. More data will be needed in order to decide whether the evidence of the interferograms is more than an artifact of the processing and data analysis. Another reviewer states that sea level fluctuation studies using InSAR techniques claimed by the team is the result of seasonal or periodic drought causing regression or transgression of sea water towards land or the opposite, and could be more economically studied by conventional field measurements than by a complicated method such as InSAR.

As can be seen, the ideas for and against the topic are challenging, and require further and profound investigation and verification – precisely as expected in conducting real research.

7

Disfavored applications and services

The statute of 2005 of the Iranian Space Agency envisaged the same emphasis being placed upon the development and promotion of both space technology and space applications. It was almost the same for the statute of 2008. However, the second statute lacked the legal supervision of the Supreme Space Council. Instead, it provided open and limitless authority to the president of the agency to conduct the agency autonomously with a considerably larger financial budget. This led to the agency devoting the majority of its resources to technology development for space transportation and orbiting satellites at the expense of space applications and services as well as specialized space cooperation. However, the disfavored space applications and services are crucial to the Iranian space endeavor. This chapter will explore the administrative structure of space applications and services at ISA, as well as the activities that are performed by the Deputyship of the Space Applications and Services (DSAS), which is one of the three main ISA vice presidencies.

7-1 SPACE SERVICES AND REMOTE SENSING

The official tasks of the former Iranian Remote Sensing Center (IRSC) are currently performed by the General Office of Space Services and Remote Sensing (GOSSRS) of the Iranian Space Agency. There is an office for remote sensing located at ISA headquarters, but the remote sensing facilities are all at the Alborz Space Center (ASC), which consists of the Mahdasht Satellite Receiving Station (which hosted the IRSC for many years), other communications antennas, satellite ground systems, and an observatory. The National Data Archive and the Remote Sensing National Laboratory are currently being developed at ASC.

GOSSRS, which is in charge of the activities covered by space services and remote sensing, hosts four branches:

- Office for Development of Applications of Space Services and Remote Sensing.
- Office for Engineering of Communication and Remote Sensing Systems.
- Office for Engineering of Space Services and Remote Sensing.
- Office for Laboratories and Standardization.

P. Tarikhi, *The Iranian Space Endeavor: Ambitions and Reality*, Springer Praxis Books,
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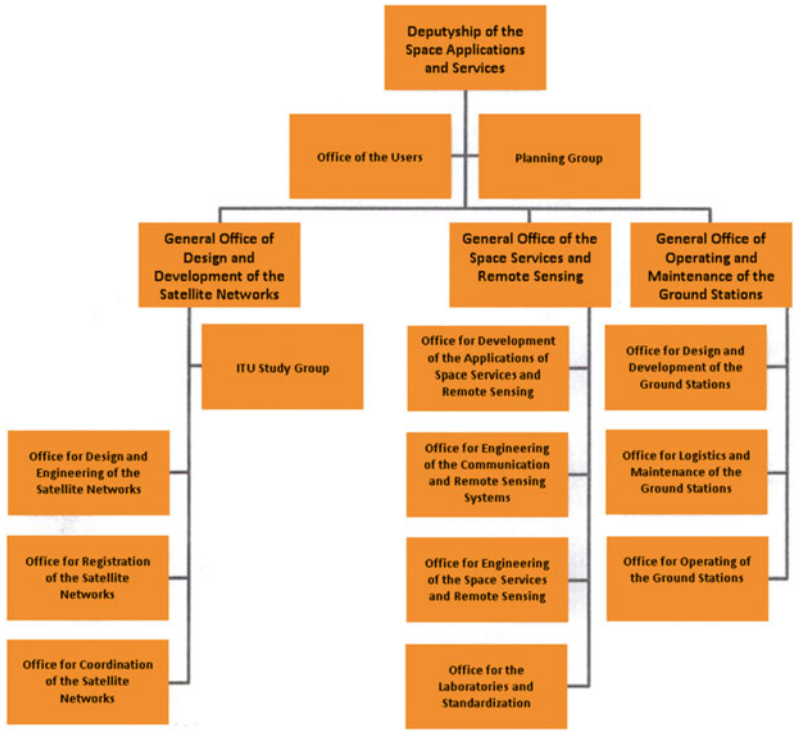

Deputyship of the Space Applications and Services
Office of the Users
Planning Group
General Office of Design and Development of the Satellite Networks
General Office of the Space Services and Remote Sensing
General Office of Operating and Maintenance of the Ground Stations
ITU Study Group
Office for Development of the Applications of Space Services and Remote Sensing
Office for Design and Development of the Ground Stations
Office for Design and Engineering of the Satellite Networks
Office for Engineering of the Communication and Remote Sensing Systems
Office for Logistics and Maintenance of the Ground Stations
Office for Registration of the Satellite Networks
Office for Engineering of the Space Services and Remote Sensing
Office for Operating of the Ground Stations
Office for Coordination of the Satellite Networks
Office for the Laboratories and Standardization

7.1 The virtual organization for the Deputyship of Space Applications and Services reflects the vision of the key authorities of ISA on space applications and services. [Author, using data on the space agency's website and other publicly available information and reports]

Its provisioned missions are planning and integration of the agenda of the Deputyship of the Space Applications and Services with that of ISA's Space Research Center, aiming for accordance with the research center. Amongst its functions are identifying available marketing potentials, both at national and international levels, in the domains of satellite communications, space services, remote sensing, and ground stations. It is planned that it will also set the necessary standards and instructions for the various user communities in the domain of remote sensing and space service. In particular, it will be involved in processing and analyzing remote sensing and other space services data, offering value-added data to users based upon their demands and requirements, and presenting plans for promoting the improved culture to benefit space services throughout Iranian society. As a result of its origins at the IRSC, remote sensing with its many 'old hands' is regarded as the primary domain of the activity of GOSSRS, but new domains are in the process of being developed.

7-1-1 Missions

The missions of GOSSRS include[295]:

- Assisting in the preparation and formulation of the policies, programs and measures for the remote sensing sector of the country.
- Contributing to the preparation and development of the quantitative and qualitative goals of the remote sensing sector, and prioritizing the programs to match the human and physical sources of the remote sensing sector.
- Performing technical studies on the different plans of the remote sensing sector and preparing pertinent reports.
- Cooperating in preparing the short, medium, and long term plans for the development of the remote sensing sector.
- Looking forward and proposing the programs, plans, projects and their needed financial sources in the annual and five-year development plans in the remote sensing sector of the country.
- Studying and analyzing the executive trend of the country's remote sensing sector programs and preparing pertinent reports.
- Monitoring all the programs and plans of the country's remote sensing sector and presenting pertinent reports.
- Monitoring and controlling all the contracts by ISA involving remote sensing technology.
- Collecting statistics and information about the different activities of remote sensing for pertinent utilization and timely presentation to the relevant addressee.
- Researching and studying the trend of the remote sensing technology development in successful countries and utilizing the study results to develop the programs of the remote sensing sector.
- Developing partnerships with universities and research centers associated with remote sensing technology, both inside and outside the country.
- Researching and studying the trend of programs and recommendations made by specialized international and regional entities, and implementing them for the remote sensing sector programs.
- Performing pertinent studies about the current status of remote sensing technology in the country.
- Performing pertinent studies about the liberalization and privatization of the remote sensing activities.
- Preparing and developing programs for the use of remote sensing technology in different parts of the country.
- Providing fields of appropriate and effective cooperation of the remote sensing sector with other sectors throughout the country.
- Planning and providing a convenient environment for the growth of activities and increasing the capacities and capabilities of the non-governmental entities of the remote sensing sector of the country.
- Contributing to the preparation and formulation of the optimum policies and strategies in the direction of promotion, and publicizing the applications and capabilities of remote sensing technology.

- Evaluating proposed major projects in the fields of establishment, equipping, development, maintenance and utilizing in the domain of remote sensing technology, and commenting on them.
- Proposing the development of the international cooperation programs in the domain of remote sensing technology.
- Cooperating in active and effective participation in domestic and international communities, unions and conferences related to remote sensing.
- Cooperating with the department of education in organizing specialized workshops and training courses related to remote sensing.

7-1-2 Applications

As the extent of remote sensing applications broadens, the number of applications in which GOSSRS is involved increases. Currently, its domains are as follows. In relation to energy studies, GOSSRS is involved with mine exploration, and oil and gas. There are many applications in the domain of natural resources studies that are covered by GOSSRS. These include agriculture, coastal zone management and monitoring, environmental pollution, environmental monitoring, forest and range, land cover and land use, geology, soil and soil erosion, oceanography and water studies, snow studies, and wildlife. Flooding, earthquakes, fires, droughts, landslides, and sandstorms are included in the domain of the natural disasters studies. In the domain of urban development studies, the topics are cadaster and real estate registry, civil engineering and surveying, urban development and planning. Studying different layers of the atmosphere and characteristics of clouds are included in the domain of meteorological and atmospheric studies. Archaeology, geographic information systems, radar, and the detection of changes are some of the topics that are dealt with independently.[296]

7-1-3 Potentials and capabilities

In general, the implementation of projects – including research and development projects in various fields, using satellite and non-satellite data and the appropriate specialized software – are considered capabilities and services of GOSSRS. These fields are natural resources, soil studies, water resources, geology, forests and rangelands, environment, coastal zone management, meteorology, unexpected events, natural disasters, energy, urban development, etc…

7-1-4 Projects

Remote sensing specialists and experts of the Iranian Space Agency, benefiting from available Earth space data, metadata and geographic information systems, have implemented a handful of projects in a variety of the fields since the IRSC started its activity. A glance at the projects (see below) reveals the extent and diversity of the topics that have been followed initially by the IRSC and later by ISA in the course of the last couple of decades[297]:

- Studying the shoreline changes of the Gomishan lagoon.
- Mapping the shorelines of the Caspian Sea and the distribution of suspended material in it.

- Establishing a Database of Geographic Information Systems.
- Generating topographic maps and converting them into 3D digital maps (DEM-DSM).
- Generating internal and external topographic maps and converting them to 3D digital maps (DEM-DSM).
- Mapping areas with geothermal energy in the south of the Khorasan Province (currently located in Southern Khorasan Province).
- Mapping the sea surface temperatures of the Caspian Sea using AVHRR thermal bands.
- Preparing 3D digital map data.
- Extracting the snow boundary using satellite data.
- Monitoring drought areas.
- Preparing and producing Iran's geography software.
- Generating digital terrain models and feature extraction using satellite imagery.
- Studying the problems related to Border Rivers.
- Generating maps of land form and land use for the provinces Sistan and Baluchestan, Gilan and Semnan, the border strip between Khorasan (currently located in Northern Khorasan Province) and Golestan provinces (100km from the border), and the Firouz-kouh and Damavand areas.
- Mapping urban services based on high-resolution satellite imagery and 1:2,000 scale maps.
- Studying the sedimentation process in the Urmieh Lake.
- Generating maps of the wheat crop yield of Ghazvin province using satellite imagery for the crop years 2002-2003.
- Mechanization of cable network information throughout the Tehran Province.
- Earthquake prediction using satellite imagery.
- Studying the thermal anomaly of Damavand.
- Studying the effect of land use on the floods discharge using remote sensing and GIS technologies.
- Assessment of the ecologic potential of Tehran margins for the future development using remote sensing and GIS technologies.

7-2 DESIGN AND DEVELOPMENT OF SATELLITE NETWORKS

The duties and functions related to the design and development of satellite networks are covered by the General Office of Design and Development of Satellite Networks (GODDSN). The main mission of this office includes the design, registration and coordination of satellite networks according to the needs and demands set by GOSSRS. It comprises three branch offices as follows:

- Office for Design and Engineering of Satellite Networks.
- Office for Registration of Satellite Networks.
- Office for Coordination of Satellite Networks.

In addition, the ITU Study Group is also active under the GODDSN. This reviews the laws, recommendations, resolutions, and circulars related to the International Telecommunication Union (ITU) radio regulations in the domain of satellite networks, participates in related conferences, and contributes to the relevant working groups and decision-making entities.

7-3 OPERATING AND MAINTENANCE OF GROUND STATIONS

The General Office of Operating and Maintenance of Ground Stations (GOOMGS) covers activities pertaining to the operation and maintenance of ground stations throughout the country. Its missions include the design and development of ground stations, maintaining them ready to support satellite communications and services, acquiring remote sensing data, monitoring and control of the space systems, and receiving and storing remote sensing data. It has three offices working under it:

- Office for Design and Development of Ground Stations.
- Office for Logistics and Maintenance of Ground Stations.
- Office for Operating of Ground Stations.

7-3-1 Alborz Space Center (ASC)

The Mahdasht Space Center was established in 1972 under a bilateral cooperation plan between Iran and the United States of America to receive data from Landsat satellites. It is located approximately 65km west of Tehran on a sprawling 42ha tract at the base of hills near Karaj. After the establishment of the Iranian Space Agency, the Mahdasht Satellite Receiving Station was revived and developed into the Mahdasht Space Center to accommodate the most comprehensive and multi-function ground space complexes as well as working, living and leisure facilities for space science and technology specialists, scientists and officials. Later, facilities were installed for command and control of the 60-day mission of the Navid microsatellite developed by the Iran University of Science and Technology. The area of the facility had increased to 180ha by 2011, when it was renamed the Alborz Space Center affiliated with ISA.

The main scientific and technical activity of ISA's GOSSRS, which carries out the functions and duties of the former IRSC, is presently concentrated at ASC. This center now possesses a number of satellite dishes, plus buildings which house control rooms for monitoring satellites. In addition to the receiver to acquire data from the High Resolution Picture Transmission (HRPT) of the US National Oceanic and Atmospheric Administration (NOAA), the UNISCAN receiver for the US Terra satellite, and receivers for the Chinese Feng Yun-2 (FY2)-C, -E and -D satellites, new installations have been added to the complex in recent years, including an optical observatory, temporary reference tracking and control ground installations for the Navid microsatellite, and facilities to monitor the frequency spectrum of Iransat-21, the Iranian transponders aboard the Badr-5 satellite whose technical name is Arabsat-5B. When the Landsat Receiving Station was active, its 10m antenna could receive Landsat 1, -2 and -3 MSS (Multi-Spectral Scanner) and RBV (Return Beam Vidicon) as well as NOAA-AVHRR with spatial resolutions of 80m, 120m and 1,100m respectively.

HRPT Receiver

Established in 1996, this station receives data from the US NOAA-18 and -19 satellites in near-polar Sun-synchronous orbits. The L-band antenna is 1.8m in diameter and it receives data from the Advanced Very High Resolution Radiometer (AVHRR) used by NOAA satellites. Its coverage extends to the north of the Caspian Sea in the north, north-east Africa in the south, western India in the east, and part of eastern Europe at the west.

7.2 The command and control antennas for the Navid microsatellite at the Alborz Space Center are on the platforms in the middle of the photo. The UNISCAN antenna for receiving MODIS data from the US Terra satellite is seen at the right on the platform. [Author]

Table 7.1. The HRPT Receiving Station of the Alborz Space Center. [ISA website].

Characteristics	
Date of installation	1996
Satellite	NOAA (18 & 19)-USA
Satellite orbit	Sun-synchronous
Antenna diameter	1.8 m
Number of the rotation axis of the antenna	2
Frequency band	L
Sensor	AVHRR3 (Advanced Very High Resolution Radiometer)
Resolution	1.1 km for all 6 radiometric bands
Coverage area	north: North of the Caspian Sea south: North east Africa east: West of India west: Part of eastern Europe
Mission	Remote Sensing
Applications	– Detecting of the global changes on land and oceans; – Surface temperature detection of land and sea; – Detection of the borders between different features such as sea, ice and snow
Operating system	MS-DOS
Number of the daily images acquired	2

The resolution of the sensor's six radiometric bands is 1.1km. The system acquires data from the satellite twice a day. The applications include detecting global changes on land and oceans, surface temperature measurements of land and sea, and detection of the borders between different features such as sea, ice and snow.[298]

UNISCAN Receiver
The UNISCAN station was established in 2001 and its mission is to receive data from the US Terra satellite in Sun-synchronous orbit. Its X-band antenna is 3.65m in diameter and it receives data from the Moderate Resolution Spectro-radiometer (MODIS) sensor of the satellite. The data resolution is 250m for bands 1-2, 500m for bands 3-7, and 1,000m for bands 8-36. Its coverage is the same as for NOAA-AVHRR, and its applications include land and oceanographic studies, detection of changes, studying the effects of the thick clouds on the rate of absorption of solar radiation by the Earth, and surface temperature measurements of land and sea. Like NOAA-AVHRR, the system acquires this MODIS data twice daily.[299]

FY-2 (C, E, D) Receiver
Established in 2006, the FY-2 station receives data from the Chinese FY-2 (C, E, D) meteorological satellites in geosynchronous orbit 28 times per day. In fact, it obtains the data from the FY-2 satellites via Asiasat-4. FY-2 transmits its data to the main receiving station in China, which then forwards it to Asiasat-4 in the Ku-band employing the DVB-S (Digital Video Broadcasting-Satellite) standard. The antenna is 2.4m in diameter. Its mount is fixed because the satellite maintains a stationary position in the sky. The SVISSR (Stretched Visible and Infrared Spin Scan Radiometer) sensor operates in the C-band. The resolution of the visible channel of the sensor is 1.25km, but it is 5km for the water vapor channel,

Table 7.2. The UNISCAN Receiving Station of the Alborz Space Center. [ISA website].

Characteristics	
Date of installation	2001
Satellite	TERRA-USA
Satellite orbit	Sun-synchronous
Antenna diameter	3.65 m
Number of the rotation axis of the antenna	3
Frequency band	X
Sensor	MODIS (Moderate Resolution Spectro-radiometer)
Resolution	250 m for bands 1&2 500 m for bands 3-7 1000 m for bands 8-36
Coverage area	north: North of the Caspian Sea south: North east Africa east: West of India west: Part of eastern Europe
Mission	Remote Sensing
Applications	– Land and Oceanographic studies; – Change detection; – Studying the effect of the thick clouds on the rate of the absorption of solar radiation by the Earth; – Surface temperature detection of land and sea
Operating system	Windows 98
Number of the daily images acquired	2

Table 7.3. The FY-2 (C, E, D) Receiving Station of the Alborz Space Center. [ISA website].

Characteristics	
Date of installation	2006
Satellite	FY-2 (C,E,D)-China via Asiasat 4 [FY-2 transmits the data to the main station in China wherefrom the data is forwarded to Asiasat-4 in Ku band using DVB-S (**D**igital **V**ideo **B**roadcasting-**S**atellite) standard]
Satellite orbit	Geo-synchronous
Antenna diameter	2.4 m
Number of the rotation axis of the antenna	fixed
Frequency band	C
Sensor	**SVISSR** (Stretched Visible and Infrared Spin Scan Radiometer)
Resolution	1.25 km for visible channel (VIS) 5 km for infrared channels (1, 2, 3, 4)
Channels	– Visible channel (0.73 μm)- VIS – Water vapor channel (6.9 μm) – IR3 – Mid-Infrared (MIR) channel (3.8 μm)- IR4 2 split-window channels including: – IR1 (Infrared 1, 10.9 μm)- IR1 and – IR2 (Infrared 2, 11.9 μm)- IR2
Coverage area	FY-2 C: from Tabriz to the east of Asia FY-2 E: from Turkey to the east of Asia FY-2 D: from whole Europe to the east of Asia
Mission	Meteorology
Applications	– Detecting of the changes on land and ocean; – land/sea surface temperature measurements; – Oceanographic studies
Operating system	Windows XP
Number of the daily images acquired	28

the mid-infrared channel and two split-window channels. The area covered by the FY-2-C satellite spans from Tabriz (in Eastern Azerbaijan) to the east of Asia. The FY-2-E satellite spans from Turkey to the east of Asia. The FY-2-D satellite spans the whole of Europe across to the east of Asia. The applications for this data include detecting changes on land and ocean, land/sea surface temperature measurements, and oceanographic studies.[300,301]

Data Archive

The available data at the archive of the Alborz Space Center exceeds 32 terabytes and contains the imagery and non-imagery data from the following sensors:

- US NOAA: AVHRR (National Oceanic and Atmospheric Administration, Advance Very High Resolution Radiometer).
- Indian IRS-1C & 1D (Indian Remote Sensing [Satellite]): Pan (Panchromatic), LISS III (Linear Imaging Self-Scanning [System]) and WiFS (Wide Field Sensor).
- US Terra: MODIS (Moderate Resolution Imaging Spectro-radiometer) and ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer).

- US LANDSAT: MSS (Multi-Spectral Scanner), TM (Thematic Mapper), and ETM (Enhanced Thematic Mapper).
- France SPOT (Système Pour l'Observation de la Terre): HRVIR-HRV (High Resolution Visible of the High Resolution Visible and Infrared [System]).
- US IKONOS: Pan (Panchromatic).
- Japan JERS 1 (Japanese Earth Resources Satellite 1): SAR (Synthetic Aperture Radar).
- Canada Radarsat.
- ESA (European Space Agency) ENVISAT: ASAR (Advanced Synthetic Aperture Radar).

Communication missions

In recent years, in addition to the remote sensing mission, new communication missions were placed on the Alborz Space Center to be carried out in accordance with the functions and duties defined and provisioned for the center. One of the new communication missions, part of which is conducted at the center, is the Iransat project. The Iransat-21 transponders owned by Iran are on the Badr-5 satellite, a joint venture by Iran and the Arabsat Satellite Corporation whose shareholders are 21 Arab countries. The Badr-5 satellite, formally named Arabsat-5B, is in geostationary orbit situated above the equator at 26ºE and it became operational in June 2010. The satellite's functions are communications and TV broadcasting and Iran owns half of its transponders, which IRIB uses for broadcasting Iran's national channels while ISA uses them for communications through a number of intermediate service provider firms. The 4.5m communication antenna for the project installed at the Alborz Space Center is a bi-axis antenna capable of tracking the geostationary Badr-5 satellite.

7.3 The 4.5m communication antenna of the Iransat-21 project installed at the Alborz Space Center. It is a bi-axis antenna capable of tracking the geostationary Badr-5 satellite. [Author]

General Information

Satellite	On-board BADR-5
Launch date	4 June 2010
Lifetime	15 years
Orbital location	26° E

7.4 General characteristics of the Badr-5 satellite that hosts the Iransat-21 transponders. [ISA: A review on the existing ground receiving stations at the Alborz Space Center (in Persian), PowerPoint presentation, 2012]

Complementing the function of the 4.5m antenna for Iransat-21 is the 1.8m fixed communication antenna installed at the Alborz Space Center for the frequency monitoring and other communication system monitoring (CSM) tasks that are essential in a modern wireless communication infrastructure. In satellite communications, CSM allows operators to monitor and to track data signals of a dedicated transponder. It helps measuring carrier high frequency parameters, which are used to derive quality of service statistics of certain satellite communication links.[302]

Observatory of the Iranian Space Agency

The idea to establish an observatory of the Iranian Space Agency goes back to the early days of the establishment of the space agency itself. According to the statute of the space agency, astronomy is one of the topics which the space agency is mandated to promote, although surprisingly it does not hold a position in the organization of the agency which, legally speaking, is still only virtual. These activities are therefore a marginal but brilliant activity pursued by a group of competent, enthusiastic and young amateur astronomers. The main thing that facilitated their efforts was the establishment of an observatory at the Alborz Space Center for a reported cost of US $250,000. This observatory is a pivotal entity for almost all of the astronomical activities by the space agency. Since May 2012 it has been outfitted with a Meade LX200GPS telescope that is mounted on top of the main building of the Alborz Space Center and covered by a dome 4m tall. Installed in hundreds of education centers and college observatories around the globe, as well as those of advanced amateurs, a Meade LX200GPS 16in telescope is the largest Schmidt-Cassegrain telescope currently available. It is nonpareil for the advanced amateurs who can appreciate what a research-class instrument can bring to their observing program, or for the school or college astronomy departments seeking a first-class teaching telescope. These telescopes have been responsible for some of the most impressive imaging ever carried out by amateurs or professionals.

One feature of this particular telescope is its Ultra High Transmission Coatings, which increase the total light transmission and image brightness by nearly 20% over the company's standard coatings. As a result, celestial objects such as stars, galaxies and nebulae appear significantly brighter. The Zero Image-Shift Micro-focuser allows obtaining precise image focus with no image movement. Since the Oversize Primary Mirror diameter

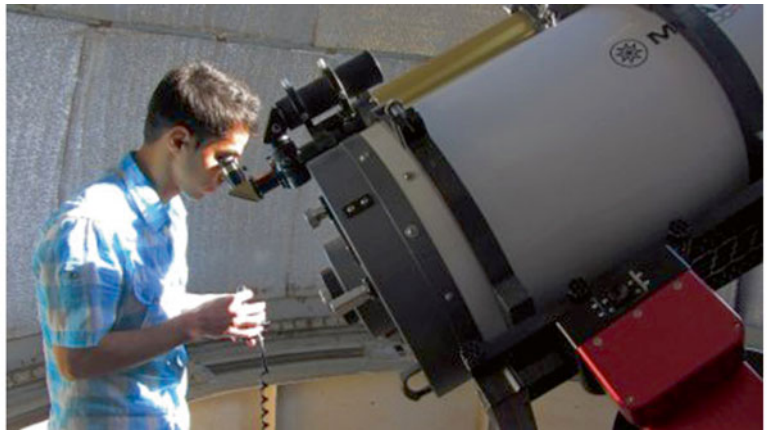
7.5 The 4m dome of the Observatory of the Iranian Space Agency at the Alborz Space Center. The observatory is equipped with a Meade LX200GPS 16in telescope. [Author]

of the telescope is greater than its real aperture, the extra wideness provides a wide field-of-view that is fully illuminated. As a result, the telescope has brighter off-axis field illuminations than Schmidt-Cassegrain telescopes which use non-oversized mirrors. The Smart Drive provides permanent periodic error correction (PPEC) on both axes by learning and averaging out errors over the course of one or more training periods, thereby minimizing the guiding corrections required for long-exposure photographs. PPEC is available on both axes and functions in both polar and alt-azimuth modes. The Sony GPS Receiver Sensor automatically inputs precise time, date, and geographical location to help quickly and precisely align the telescope. The Smart Mount constantly refines pointing accuracy each time an object is centered and updated. This is compatible with both equatorial and alt-azimuth mounts. The AutoStar II Controller features Hot Keys for quick access to a database of 145,000 celestial objects. This can be updated with the latest software upgrades, guided tours, and timely objects such as comets. For the Meade LX200GPS 16in telescope the focal ratio is F/10 and the focal length is 4,064 mm, so it is a compact instrument.

Although the site of the Alborz Space Center is not ideal for space observations and astronomical research, it has enabled a considerable number of enthusiastic young astronomers to make individual and group observations based on a scheduled timetable. Plans are underway to find a suitable location for a second observatory for ISA.

Plans under development

There are a number of plans to expand the activities of ASC. The establishment of a National Data Archive of Space Data and a National Remote Sensing Laboratory are in implementation, and are expected to be completed in the near future.



7.6 The Observatory of the Iranian Space Agency at the Alborz Space Center and its Meade LX200GPS 16in Schmidt-Cassegrain telescope has made space observation and astronomical research possible for a large number of enthusiastic young astronomers and astrophysicists. [IOTA-ME]

National Data Archive
The plan to construct a National Archive of Space Data at the Alborz Space Center was initiated in October 2012 in the course of World Space Week. This is a joint venture by ISA and the Advanced Information and Communication Technology Research Center of the Sharif University of Technology. The project is provisioned to install the software systems including:

- Monitoring and warning based on satellite data.
- Geo-spatial portal.
- Organizing and archiving of satellite data.
- Assessment of the needs of the user community for remote sensing data.
- Virtual training.

The Data Center of ISA includes Network, Security, Servers, Data Storing network and related facilities.

National Remote Sensing Laboratory - Spectral Lab
This laboratory is planned to assist the research needs of scientists and researchers involved in the development of remote sensing and Earth observation technologies and their applications.

7-3-2 Ongoing plans for developing other ground stations

The Mahdasht Space Center hosts a number of active ground stations, and there are plans to develop new ground stations throughout Iran. Presently, the GOOMGS of ISA actively follows the projects to build stations in Tabriz, Isfahan, Shiraz, Mashhad, Chabahar and

Gheshm to enable the space agency to execute its mandate to provide the means for the country to develop beneficial services for remote sensing data acquisition, satellite communications, broadcasting, data transfer and other relevant services.

7-4 AUXILIARY OFFICES

In addition to the three main general offices of the Deputyship of Space Applications and Services, a further two offices are active under the deputyship. These are the Planning Group and the Office for Customer Services and Support.

7-4-1 Planning Group

The mission of the Planning Group is to plan and control projects implemented under the Deputyship, including projects related to users, to plan and develop satellite networks, space services and remote sensing, and to operate and maintain the ground stations. This group is a means of improving control of the implementation of the activities of the Deputyship of the Space Applications and Services.

7-4-2 Customer services and support

The Office of Users aims to market, promote and offer space services in the domains of both remote sensing and communications to all the beneficiaries and customers of the space services. Its functions include pricing, marketing and propagandizing the customer services and technical support provided by other divisions of the deputyship. It is involved in the activation of Inmarsat terminals, vending frequency bands, providing remote sensing data to universities for use by students and educational staff, and selling remote sensing data to relevant customers.

7-5 ADMINISTRATIONAL STATUS OF REMOTE SENSING

Iran has a long history in the remote sensing field, initially with the IRSC and later with ISA, but there has been considerable criticism. The major part of this criticism about the institutional remote sensing goes to the vision held by its managers and authorities and their obvious mismanagement. At the very outset it was the applications of remote sensing technology that were developed in Iran. The technical and scientific aspects were always at the margins. Denied the income that was gained from the work of the mainly emerging non-technologist staff in implementing developmental application projects, the IRSC gradually lost its primacy and qualification in terms of the technology and the basics of remote sensing in competition with the academic and private sectors. The reason was that the existing corps of remote sensing was reluctant to change its structure and reform itself to compete in an arena in which a deep knowledge of remote sensing was a prerequisite. This condition persuaded the authorities of the remote sensing component to act the role of a mere broker, controlling and checking the flow of funds from the IRSC and ISA to the

contracting counterparts and executors in the academic, private, and non-civilian sectors. The remote sensing activity of the agency is under the exclusive control of an unqualified group with a rotten and outdated vision of the technology and reality of remote sensing, and in the absence of thorough oversight they were readily corrupted by the commissions from this brokerage.

The institutional remote sensing in Iran that was firstly carried out by the IRSC and then moved to ISA has stepped in the opposite direction over the course of recent decades, like 'playing the trumpet from its flared end.' The end users have become the decision-makers of remote sensing technology in Iran. These people very often came from disciplines such as the humanities, environmental studies, agriculture, and so on. Their expectations and understanding of the technology and the philosophy of its inception and growth was poor, and there was always a great gap between their reasoning and the realities. The presence of the end users majorly in the position of technologists and decision-makers has caused lots of harm for the advancement of the remote sensing technology in Iran, the thing that has raised lots of criticism for around three decades. However, the malformed body of remote sensing in Iran has been incapable of self-improving and reforming. As a result, the traditional remote sensing part of the country's space agency has become a second-class component whose outcomes are always unpromising for the authorities while it is always reflected in the form of grievance and complaints by them.

Owing to its long background, the corruption in the remote sensing section is more influential than other sections of the space agency. More or less lifelong managements, monopolism, deeply rooted collusions, cozy relations, disrespecting the competencies and the rule of cliques clandestinely generated by a corrupted staff has led to the decline of the quality and efficiency of the remote sensing section – particularly in the last decade. Although the existence of corruption in the remote sensing section has been criticized and reported frequently, no interest in tackling this situation has yet been shown by the authorities and the newcomers have always tried to strengthen the existing corrupted relations and routines. After all, to revive and reinvigorate this important activity of the Iranian space endeavor, a deep housecleaning is required and without doing so, the effective contribution from the remote sensing part of the agency will be of no avail.

8

Development of domestic space apparatus and launchers

As explained in Chapter 4, the Zohreh, Mesbah, SMMS and Sina-1 projects were conceived in the context of joint multilateral or bilateral international cooperation. Zohreh was a large and expensive commercial satellite, while Mesbah was a small, low cost satellite for commercial and experimental uses. SMMS and Sina-1 were also relatively heavy satellites with commercial functions. However, the design and manufacture of a new group of satellites, the first of which was Omid, has been conducted in a different manner to that former group of satellites. The new group of satellites is the outcome of a strategy and vision introduced in 2005. In all, two primary outcomes were expected from developing and launching these new satellites: internal usage and international usage. The internal aim was to stir the nation and promote national pride, as well as possibly a type of self-sufficiency. The international usage enabled the government to attempt to show its strength and power, exposing its claws and teeth to the world. The staff and people involved with these plans were not necessarily particularly clever. Perhaps aware of this, they attempted with dissimulation and opportunism to exploit the possibilities and windfall opportunities arising from the lack of wisdom and competence in the highest layers of government and state.

In this chapter, this new group of satellites will be explained in detail. It is notable that the close similarities in their functions and duties implies there has been no open-eyed and intelligent vision on the part of the designers, who have ignored economic considerations in the design and manufacturing of the satellites. This is an indication that in setting up such plans the managers and leaders lacked the necessary experience, expertise, and knowledge in this connection, with the result that the whole job seems to have been a case of 'reinventing the wheel'. The main reason for this is the non-methodical injection of funds into the academic and martial sources responsible for designing and manufacturing the satellites. In the absence of an efficient and persistent control, auditing and investigation process, the result was major embezzlement of the financial sources.

P. Tarikhi, *The Iranian Space Endeavor: Ambitions and Reality*, Springer Praxis Books,
DOI 10.1007/978-3-319-05347-9_8, © Springer International Publishing Switzerland 2015

8-1 DOMESTIC SATELLITES

In recent decades, due to the functionality and successful design, manufacturing and launch of small satellites by many countries, the development of space science and technology is no longer seen as being reserved to the major players in this arena. The reasons for countries to manufacture satellites are to accommodate their vital needs. Hence, in aiming to develop and publicize space technologies, a significant number of the leading academic entities around the globe have designed, manufactured and launched small satellites for experimental purposes. Furthermore, a large number of non-governmental organizations and individual companies have developed the means, staff, and management to design, manufacture and operate a variety of small satellites for low cost missions. Apparently, because of the low cost of designing, manufacturing and launching small satellites, their trend of development and progress will be enhanced and the developing countries will further commit to creating the necessary infrastructure in this regard, and training expert human resources. The advantages of small satellites over large satellites include the relatively low cost of their development and launch, the lack of need for sophisticated ground infrastructure, a low risk vulnerability, and a capability for rapid technology growth. Small satellites are widely used for communications, Earth observation, scientific research, transportation, oil and gas exploitation, agriculture, tele-health and education, and so on.

Several ministries in Iran have long been involved in satellite development, but the commitments by the academic institutions and centers are new. By the successful launch on February 2, 2009 of its first indigenous telecommunication satellite, Omid, Iran has started a new approach to the designing, manufacturing and launching of satellites. Although Omid was an experimental small satellite with a 50-day mission of making orbital measurements,[303] the experience gained in operating it opened the door to create more sophisticated systems carrying Earth observation apparatus and communications and research apparatus.[304]

In 2010 Iran developed a more powerful launch vehicle named Simorgh to place heavier satellites of 100kg into 500km orbits. In addition, the country has seen a boom in designing and more or less developing new satellites,[305] among which student small satellites are of particular importance. From its early days, the Iranian Space Agency has sought active links between itself and universities for the purpose of capacity building. This was fulfilled by developing student small satellites in a number of leading Iranian universities. In contrast to this positive and essentially popular face of the activity, is the fact that these 'student satellites' were not mainly designed, manufactured or handled by genuine students as expected and comprehended from that expression in the global norms.

Nevertheless, the quantitative growth of the student and small satellites developed after the launch of Omid sounds promising. Of the earlier Zohreh, Mesbah-1 and Sina-1 projects, the only one which was actually launched was Sina-1 on October 27, 2005. This achievement made Iran the 43rd country in the world to own a satellite in orbit.[306] Then how should the aberration be adjusted? In recent years a considerable amount of state funding has been allocated to persuade the academic and non-civilian sectors to work either jointly or individually on designing satellites, launchers and rockets. This rise in funding has

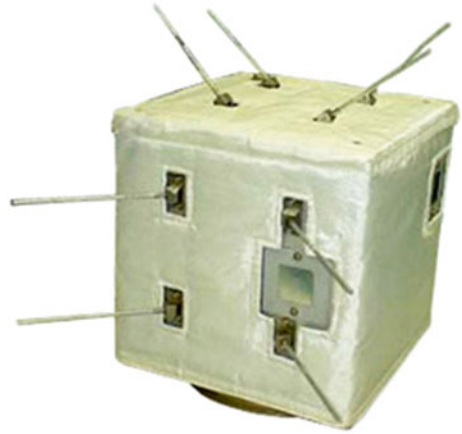
produced a quantitative increase of plans and projects for the design and manufacture of satellites. However, there should be concentrated and unified policy-making, budgeting, and efficient missions and functions. Such management requires the national space agency to be supervised by the Supreme Space Council. Open-mindedly enabling the efficient contribution of genuine and competent talents in terms of management and science and technology development is the great necessity in this arena. In the meantime, information, knowledge and expertise sharing between the working groups of the universities and other bodies involved in satellite development should be given priority.

There is an allegory for this situation in the Iranian tradition in the form of the famous narrative of Simorgh, a fabulous bird that flies above the clouds. The word Simorgh in the Persian language is also expressed as Si-morgh, meaning 'thirty birds'. There is a philosophical interpretation of the concepts of Simorgh and Si-morgh. Once a group of thirty different hungry birds that were flying over a field decided to land and take the seeds on the ground. They were unaware that a hunter had laid a trap for them, and as soon as they settled and began to feast the trap was closed and they were caught. Each of the horrified birds attempted to escape by flying in a direction that was different from the others. This was useless. The hunter rushed toward the trap. Although time was scarce, the birds continued to flap their wings to no avail. Then one of the birds that was wiser suggested that instead of trying to fly in different directions, all thirty birds should try to flap and fly up in a single direction. By doing so, the birds lifted the trap into the sky and once beyond the reach of the hunter were able to free themselves. By working together, the thirty birds became a Simorgh that was capable of achieving what the birds were unable to do independently.

8-1-1 Omid, Iran's first indigenously experimental satellite

Iran's great leap in the space technology industry was realized early in February 2008, when its first space launch center was opened at the headquarters of the Iranian Space Agency in Tehran, although the center itself was situated in the desert of Semnan province in the northeast of Iran. This site was used to launch Iran's first homemade satellite, Omid, with a satellite launch vehicle (SLV) that was designed for that purpose. The state television channel announced that by gaining the technology to manufacture a satellite and launch it into space, Iran had entered the club of the world's top eleven countries.[307]

'On February 2, 2009, Iran successfully launched its first domestic SLV named Safir-2, carrying our first domestic telecommunication satellite called Omid, and injected the satellite into LEO,' said Reza Taghipour, at that time president of the Iranian Space Agency, in a report on the Omid satellite launch which he presented to the 46th Meeting of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space (COPUOS) held in Vienna, Austria, February 9-20, 2009. He added, 'This is definitely a great step forward towards development in space technology. I would like to inform you that all the work from design to manufacturing to test and operation of the satellite and its launch vehicle has been done by Iranian experts and engineers.'



8.1 With its successful launch of the Omid satellite, Iran became the ninth country in the world to send an indigenous satellite into space by a self-developed launcher. [Iran & Power]

Table 8.1. A list of the countries that benefit from their own independent satellite launching and manufacturing capacities. [Author].

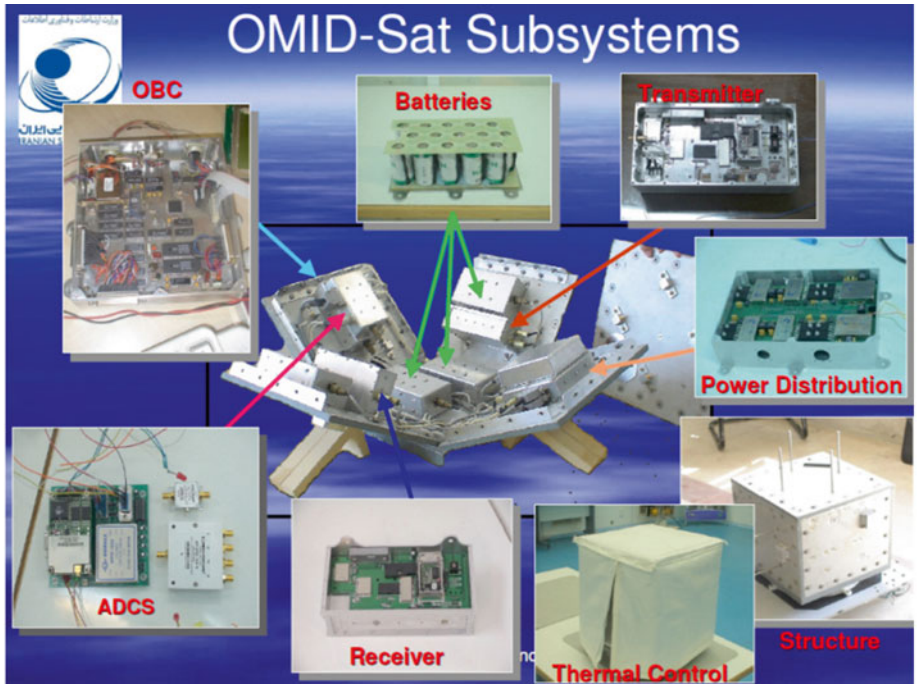
Country	*Satellite*	*SLV*	*Launch Site*	*Date (UTC)*	*Continent*
USSR/Russian Federation	Sputnik-1	Sputnik-PS	Baikonur, USSR	October 4, 1957	**Euro-Asia**
USA	Explorer-1	Juno I	Cape Canaveral, USA	February 1, 1958	**North America**
France	Astérix	Diamant A	Hammaguir, Algeria	November 26, 1965	**Europe**
Japan	Ōsumi	Lambda-4S	Uchinoura, Japan	February 11, 1970	**Asia**
China	Dong Fang Hong I	Long March-1	Jiuquan, China	April 24, 1970	**Asia**
UK	Prospero X-3	Black Arrow	Woomera, Australia	October 28, 1971	**Europe**
India	Rohini-1	SLV	Sriharikota, India	July 18, 1980	**Asia**
Israel	Ofeq-1	Shavit	Palmachim, Israel	September 19, 1988	**Asia**
Iran	Omid	Safir-2	Semnan, Iran	February 2, 2009	**Asia**

The launch of Omid, which means ‘Hope’ in the Persian language, put Iran in the club of nine countries to have independent satellite launching and manufacturing capacities. The former Soviet Union launched the world’s first artificial satellite, Sputnik, in October 1957. The USA was the next with the successful launch of the Explorer-1 in January 1958. Then there was France in 1965, Japan in 1970, China in 1970, the UK in 1971,

8.2 The Safir-2 Satellite Launch Vehicle that carried the Omid satellite into space. [Fars News Agency]

India in 1980 and Israel in 1988. In placing Iran among the top *eleven* countries, the state television channel may have included the unsuccessful efforts of Brazil using indigenous launchers and satellites, and the launch of Ukraine's Strela-3 satellite on September 28, 1991 when the country was still under the former Soviet Union. Iran was the first country to reach outer space using its own independent satellite launching and manufacturing capacities in the new millennium.

The development of Omid began in February 2006. It was a 40cm cube of 27kg that operated as a store-and-forward telecommunication satellite in the UHF band. Its thermal control was passive. The orbit was inclined at 55.71 degrees to the equator, its apogee was 381.2km, its perigee was 245.5km, and its nodal period was 90.7min.[308] Omid was developed at the non-civilian telecommunication firm SAIran. It flew in an orbit with an average altitude of approximately 250km and passed over Iran six times per day. It was actually the country's second satellite, because the first was the Russian-made Sina-1.[309]



8.3 The Omid satellite subsystems. [Reza Taghipour: 'Omid Satellite Launch Report' presentation by the president of the Iranian Space Agency and the Delegation member of the Islamic Republic of Iran to the 46th Scientific and Technical Subcommittee Meeting of the Committee on the Peaceful Uses of Outer Space (COPUOS), February 9-20, 2009, Vienna, Austria]

Because the Omid project was the first step in building an indigenous satellite, the most important and complicated task prior to producing a domestic product was to set up the requisite infrastructure for the satellite industry. The development of Omid involved different phases that included setting up of the satellite's electronics, building the space receiver and transmitter, quality systems management, thermal vacuum testing, environmental testing for quality assurance, establishing the space GPS for tracking, mounting the ranging facility, satellite flight simulation, space system engineering, satellite in-orbit operation, period and satellite rise assessment, and necessary software development. The main achievements of the Omid project were manufacturing the first domestic space system, acquiring the space technology to drive other industries, persuading academia to cooperate and contribute to the development of space technologies, capacity building in satellite manufacturing, integration and test, cooperation with the private sector, interaction between launcher, satellite and ground stations, design and manufacture of the first domestic telemetry, tracking and command (TT&C) station, design and implementation of satellite monitoring and control, and telemetry coding and decoding, as well as satellite tracking software. In developing the control and navigation technologies, the country gained experience in navigation systems, power sources, power storage, actuators,

8.4 The passes by the Omid satellite. [Reza Taghipour: 'Omid Satellite Launch Report' presentation by the president of the Iranian Space Agency and the Delegation member of the Islamic Republic of Iran to the 46th Scientific and Technical Subcommittee Meeting of the Committee on the Peaceful Uses of Outer Space (COPUOS), February 9-20, 2009, Vienna, Austria]

barometers, cabling and testers. In structures development, high thermal and mechanical resistances were experienced. The velocity and acceleration sensors were amongst the achievements in sensor technologies, and these also required expertise in application of navigation systems. Omid's ground network included three TT&C stations, one central flight control station, four ranging stations, and ground receiving stations and terminals.

Based on official reports, the mission of Omid was concluded on March 24, 2009, some 50 days after its launch. The reentry of the satellite into the atmosphere was not announced officially but this occurred in mid-April 2009. The second stage of the Safir-2 decayed before the end of May 2009.

Omid was an experimental small satellite with a short-term mission for orbital measurements. The experience and knowledge gained by orbiting and operating it paved the way for Iran to advance into space with sophisticated remote sensing apparatus for the benefit of the country and humanity.

According to the president of ISA, sophisticated and expensive space technologies have been achieved by only a limited number of countries, and Iran fully intends to attain independence in the development of space services in the course of its Fifth and Sixth Five-year Development Plans. The successful launch of Omid caused a considerable enthusiasm for design and manufacturing of micro- and nanosatellites in the country, particularly the ones that were designed in academic and research institutions with different missions. However, there are also plans for larger satellites to be used for management and monitoring of natural disasters, earthquakes, natural resources, agriculture, etc. In this connection, three satellite design and manufacturing programs have been initiated jointly with three leading technical universities: the Iran Amir-Kabir University of Technology (AUT), the Iran University of Science and Technology (IUST), and the Sharif University of Technology (SUT). The funding allotted for each of these programs exceeds US $10 million according to Reza Taghipour, the former president of ISA.

Table 8.2. Details of the Iranian satellites. [Author].

Satellite	*Weight (kg)*	*Size (cm^3)*	*Orbit*	*Launch date*	*Life span*	*Launcher*	*Launch site*	*Manufacturer*	*Mission*	*Payloads specifications*	*Cost (million US$)*
Zohreh	>1000	na	Geo	na	15y	na	na	MCIT	telecommunications		132
Mesbah[-1]	65	70x50x50	Sun	na	5y	na	na	ITRC, IROST, CGSC	store & forward communications		10
SMMS/ Environment-1	490	83x85x133	Sun	6/09/2008	>3y	Chinese Long March 2C	China	China, Thailand & Iran under APSCO	remote sensing environmental-monitoring communications	CCD Camera	44 (6.5 share of Iran)
Sina-1	160	80x130x160	Sun	27/10/2005	3y	Russian Kosmos-3M	Plesetsk, Murmansk	IIAR & Russian Federation	remote sensing disaster monitoring communications	50m Pan 250m MS	15(8 for satellite and 7 for launch services)
Omid	27	40x40x40	Sun	2/02/2009	50d	Safir-2	SLC	SAIran/ MODAFL	store & forward communications	store & forward	~0.5
Rasad	15.3		Sun	15/06/2011	21d	Safir-1B	SLC	MATU/ MODAFL	remote sensing meteorology disaster monitoring	Image res. 150m	
Navid	50	40x40x40	Sun	3/02/2012	2m	Safir-1B	SLC	IUST & ISA	remote sensing	Image res. 400m	10
AUTSat	~80		Sun		3-5y	Simorgh		AUT	remote sensing store & forward	120m	10
SUTSat			Geo					SUT	communications		10
Tolou	100	Hexagonal shape with 0.86m base and 1m height	Sun	na	2-3y	Simorgh	IKLC	SAIran	remote sensing reconnaissance	50m SIGINT	

Fajr	50		Sun	na	1.5y + 1.5y	Safir-1B	IKLC	SAIran	remote sensing reconnaissance	Image res. 500–1000m
Nasir-1	na		Sun	na					navigation	
Zafar	80-90		Sun	na	1.5y	Simorgh	IKLC	IUST	remote sensing	80m
Mesbah-2	70	70x50x50	Sun	na	3y	Simorgh	IKLC	SRI	store & forward communications & navigation	
Nahid	50-60		Sun	na		Safir-1B		AUT & ARI	communications	
Ghaem	~1800		Geo	2016		Simorgh	IKLC		Communications & TV Broadcasting	12 transponders
Iransat-1	~70		Geo	2016		Simorgh	IKLC		Communications & TV Broadcasting	
Iransat-2	~50		Geo	2017		Sarir	IKLC		Communications & TV Broadcasting	1 KU Transponder
Iransat-3	~250			2020		Sarir	IKLC		Communications & TV Broadcasting	FSS and BSS KU Transponders
Pars Sepehr								SAIran & ISA	remote sensing	
Pars-2								ISA	remote sensing	
ZS4										
Sina-2	na	na	Sun	na	na	na	na	na	remote sensing disaster monitoring communications	50m Pan 250m MS
SM2S										
Saar								KNTU		

Table 8.2. *cont.*

Satellite	*Weight (kg)*	*Size (cm^3)*	*Orbit*	*Launch date*	*Life span*	*Launcher*	*Launch site*	*Manufacturer*	*Mission*	*Payloads specifications*	*Cost (million US$)*
APSCO Sat											
Besharat							Iran	Iran, Pakistan, Malaysia and Turkey			
Muhammad-1	na								na		

Abbreviations
APSCO: Asia Pacific Space Cooperation Organization
AUT: Amir-Kabir University of Technology
CGSC: Carlo Gavazzi Space, Milan, Italy
d.: day
Geo: geo-synchronous
IIAR: Iranian Institute of Applied Research
IKLC: Imam Khomeni Launch Center
IROST: Iranian Research Organization for Science and Technology
ISA: Iranian Space Agency
IUST: Iran University of Science and Technology
ITRC: Iran Telecom Research Center
KNTU: Khajeh Nasir-e Toosi University of Technology
m.: month
MATU: Malek Ashtar Technical University
MCIT: Ministry of Communications and Information Technology
MODAFL: Ministry of Defense and the Armed Forces Logistics
MS: Multi-spectral
Pan: Panchromatic
res.: resolution
SAIran: Iran Electronics Industries Organization
SLC: Semnan Launch Center
SMMS: Small Multi-Mission Satellite
SRI: Space Research institute
Sun: sun-synchronous
SUT: Shahrif University of Technology
y.: year

8-1-2 Rasad

In line with research and development plans in space science and technology, on June 15, 2011 a Safir Satellite Launch Vehicle placed the Iranian satellite Rasad into an orbit that had an apogee of 288km, a perigee of 246km, an inclination of 55.7 degrees and a period of 91min. The satellite's main mission was to assess its various remote sensing subsystems and to provide images with appropriate resolution for meteorology and natural disaster management applications. This 15.3kg satellite with a life span of 21 days performed its mission successfully, beaming images with 150m resolution to its receiving station and reentering the atmosphere on July 6, 2011.[310]

8.5 Artificial impression of the Rasad satellite. [Space Science]

Rasad was equipped with body-mounted solar panels to generate power for the batteries, with no limitation in the power source. All stages of design, construction, project management and testing of the satellite were carried out based on the European Air Charter Safety Foundation (ACSF) standards according to which the subsystems were tested separately. The two-stage Safir-1B launch vehicle put the satellite in an elliptical orbit at an average of 260km.[311] The full name of Rasad (Observation) was Rasad-1. It was the third Iranian satellite and the second to be orbited using an indigenous launcher. It was the country's first imaging satellite, and was a joint development by the Malek Ashtar Technical University affiliated with the Ministry of Defense and Armed Forces Logistics, and the Ministry of Communications and Information Technology.[312]

8-1-3 Navid

From its earliest days, ISA aimed at capacity building and encouraged active links between itself and academia. In particular, it developed student satellites with a number of leading universities. The 50kg Navid microsatellite that was launched on February 3, 2012 was the first satellite to be constructed by the Iran University of Science and Technology (Elm-o-Sanat University of Iran) in conjunction with ISA. This Earth observation satellite traveled around the globe in an orbit having an apogee of 375km, a perigee of 250km, an inclination of 55 degrees and a period of 90min. It passed over the country six times per day.

Also known also as Ya Mehdi, Navid was a 40cm cube to test a camera for taking Earth imagery and collecting weather data, and the associated telecommunications link. The satellite had a life span of 2 months.[313] It was publicly showcased on February 3, 2010, had a store-dump capability and the resolution of its imagery was 400m.[314]

8.6 Navid satellite. [Iran & Power]

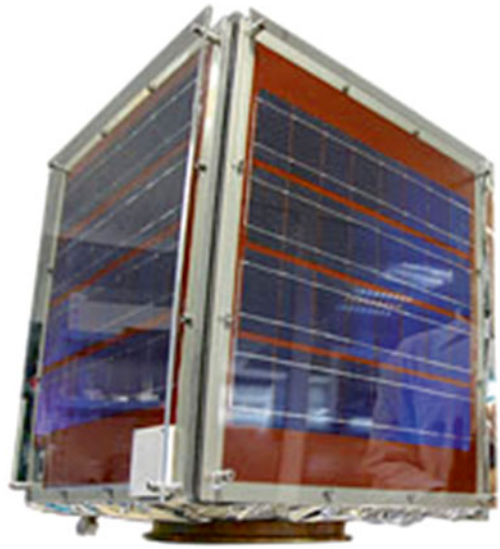
Navid was the third satellite to be launched indigenously by Iran, and was placed into orbit by a new configuration of the Safir-1B satellite launch vehicle whose second stage was larger with 20% greater thrust. The funding allocated for the Navid satellite program was reportedly about US $10 million.

8-1-4 Other satellites on the launch list

AUTSat: A student microsatellite with a remote sensing mission and a secondary mission to store and forward the information. It weighs approximately 80kg and has an expected life span of 3 to 5 years. It is being built by the Amir-Kabir University of Technology, a leading university of Iran, in conjunction with ISA.[315,316] The Simorgh Launch Vehicle will put it into a Sun-synchronous orbit at an altitude of 660km.[317] According to Reza Taghipour, former president of ISA, the funding allocated for AUTSat is around US $10 million.

Sharif University of Technology Satellite: This satellite is being developed by the Sharif University of Technology based in Tehran, and will reportedly be launched into orbit by exploiting the experience gained from launching previous satellites. No more information is officially available about this student satellite, but it is expected to be launched as soon as the indigenous launching capability is attained.[318] According to ISA, the budget allocated for this satellite is about US $10 million.

Tolou: The first domestic remote sensing microsatellite planned to acquire images of the Earth with a resolution of 50m. The satellite weighing 100kg is hexagonal in shape with a 86cm base and a 100cm height. Its imagery products will be used for synoptic land



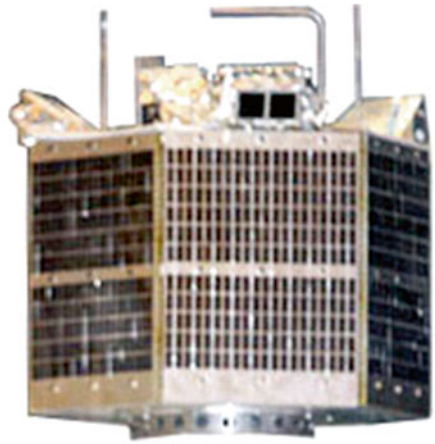
8.7 AUTSat; Amir-Kabir University of Technology satellite. [Iran & Power]

8.8 The Tolou satellite. [Iran & Power]

mapping, monitoring of water bodies and environmental disasters, agricultural areas and forests, urban distribution, and cloud coverage.[319] Of course, being developed by Iran Electronics Industries it will also have signals intelligence (SIGINT) capabilities.[320–322] Signals intelligence is a type of intelligence gathering that intercepts not only the signals between people, but also those electronic signals not directly used in communications. Since sensitive information is usually encrypted, signals intelligence often involves the use of cryptanalysis. Moreover, in SIGINT the traffic analysis that deals with the study of who is signaling whom and in what quantity can also produce valuable information, even when the messages themselves cannot be decrypted.

Tolou will be launched using the Simorgh Launch Vehicle from the Imam Khomeini Space Center located in Sistan and Baluchestan Province in southeastern Iran, which is the nation's second satellite launch site.[323]

Fajr: This is a remote sensing reconnaissance satellite developed by the non-civilian Iran Electronics Industries Organization (SAIran) affiliated with the Ministry of Defense and Armed Forces Logistics. Attempts to launch it in May and October 2012 by a Safir-1B launch vehicle failed.[324] It now will be launched using the Simorgh.[325,326] The satellite carries an experimental homemade GPS system. The camera will have an imaging resolution of 500-1,000m and the solar-powered satellite will have a life span of 1.5 years. It will be the first Iranian satellite to use pulsed plasma thrusters (PPT), a type of spacecraft propulsion system that is also known as plasma jet engines. They apply an arc of electric current adjacent to a solid propellant in order to deliver quick and repeatable bursts of impulse. PPTs are very suitable for attitude control and for main propulsion for particularly small spacecraft with a surplus of electricity. However, with a thrust efficiency of less than 10% they are also one of the least efficient electric propulsion systems. At present they are used in space vehicles and space probes. The extremely quick and repetitive thrust accelerates the space probe continuously. Through prolonged use it can exceed the speeds of



8.9 The Fajr satellite. [Mashregh News Agency]

conventional propulsion systems. The electrical energy required to operate the arcing mechanism has to be abundantly available by harnessing the solar energy by self-adjusting solar panels. PPTs provide much higher exhaust velocity than chemical propulsion engines, which is good because momentum is proportional to the square of the velocity. PPTs were the first electric thrusters to be deployed in space.[327]

Nasir-1: Iran's indigenously designed satellite navigation system is being manufactured in order to find the precise locations of satellites moving in orbit. Satellite navigation (SAT NAV) is a system of satellites that provide autonomous geo-spatial positioning, mostly with global coverage. The system enables small electronic receivers to process time signals transmitted along lines of sight by satellites to determine their locations in terms of longitude, latitude, and altitude with the accuracy of several meters. Receivers calculate both the precise time and position, which can be used as a reference for scientific experiments.

Zafar: A remote sensing satellite that was scheduled to be launched in 2012 on a Simorgh, but has been delayed. With a weight of about 85kg, it will provide an image resolution better than 80m that can be utilized in meteorology and for the demarcation of water borders and charting topography of the tributaries of rivers.[328]

Mesbah-2: This improved form of the Mesbah-1 satellite is designed for communications, data store-and-forward, and navigation with the coverage area including Europe and America in addition to Iran itself.[329–331] It is expected to be launched by the Simorgh from the Imam Khomeini Space Center in southeastern Iran. When international sanctions made it impossible to complete the original Mesbah (Lantern in the Persian language) satellite, Iran opted to indigenously design, manufacture and launch a successor. With 70kg of mass, it will have a store-dump capability, its own navigation system and a life of 3 years. Italy's Carlo Gavazzi Space S.p.A, was hired to build the original Mesbah satellite for LEO telecommunications. It was not launched because both Russia and Italy terminated cooperation with Iran on space projects. It was reported in April 2011 that under the pretext of the international sanctions the satellite which the Italians built was never delivered to Iran.

8.10 The Zafar satellite. [Iran & Power]

8.11 The Mesbah-2 satellite. [Iran & Power]

Nahid: This communications satellite with folding solar panels was designed and manufactured jointly by the Amir-Kabir University of Technology and the Aerospace Research Institute of ISA to operate in the Ku-band. Weighing around 55kg, the satellite will be launched by a Safir-1B into an orbit with an apogee of 370km and a perigee of 250km. Once in space, an experiment for deploying solar panels will be performed. Although it was planned to be launched in 2012, its launch has been postponed.[332] The experience and the results gained from launching Nahid will be used for the launch of Iransat-3.

Ghaem: This geosynchronous communication satellite is scheduled to be launched by Iran by 2016. Having a life span of 15 years, this 1.8ton satellite will broadcast TV and radio channels, the greater weight being due to its reported payload of 12 transponders. According to the ISA authorities, Ghaem will be positioned at the geostationary location assigned to the suspended Zohreh satellite project.[333]

Iransat-1: An experimental telecommunication satellite that is in the process of development. It will be launched in 2016, enabling the country to develop the capability for reaching geostationary orbit. The experience gained from launching Iransat-1, Iransat-2 and Nahid will be applied to Iransat-3.[334]

Iransat-2: This experimental telecommunication satellite will complement Iransat-1 in the group of Iransat satellites. It will carry a Ku-band transponder. Iransat-2 will be launched in 2017, a year after its predecessor. The experience gained from launching the new satellite will be used for a successful launch of Iransat-3.[335]

Iransat-3: A satellite that will substitute for the suspended Zohreh satellite project by 2020. The Zohreh satellite project has reportedly been suspended, and Ghaem and Iransat-3 will take over the functions expected from Zohreh. This new project was to start in 2013. The reason for suspending the Zohreh project is that for launching the satellite, which weighs more than 1,000kg, a launch site in the southern territory of the country is needed and its launch requires a special advanced propulsion technology. A timescale of 10 years is therefore appropriate. The launch of a geostationary satellite is easier and cheaper if it occurs from a site closer to the equator. It was the planned 12 transponders for Zohreh that made the satellite even heavier. The Iransat-3 satellite, which is provisioned to be launched in 2020, will provide both Fixed Satellite Service (FSS) and Broadcast Satellite Service (BSS) transponders. It will be launched into the geostationary location of 12.5ºE, and will be the first Iranian communications satellite to provide TV and Internet services. The interruption of broadcasting Iran's television programs by foreign satellites following political disputes between the government and the world community has, in addition to the suspension of the Zohreh project, led Iran to pursue the Iransat-3 satellite project more seriously.[336]

Pars Sepehr: A remote sensing satellite whose launch date has yet to be confirmed.

Pars-2: A remote sensing satellite whose launch schedule has yet to be announced.

ZS4: An Iranian satellite whose mission and launch date have yet to be revealed.

Sina-2: A small satellite that is planned to perform the same mission as Sina-1.

Saar (Starling): A satellite to be produced by the Khajeh Nasir-e Tusi University of Technology in Iran, but no further details have been reported.

8-1-5 Satellite projects for implementation under international cooperation

In recent years, Iran has made little progress in international cooperation in space activities owing to the many limitations and bans imposed on the country by the world community. The unfavorable contribution of Iran to the SMMS project is an example. Prior to committing to enter into the plans to be carried out under international or regional cooperation, Iran must attempt confidence building and draw the trust of provisional partners for cooperation and coalition. Manufacturing satellites under such international or regional cooperation plans is one possibility, amongst others. Although there is no detailed information about this group of satellites that are mainly proposed by Iran's official space authorities, their names are on the tongues of the people of the official and specialized space-related circles.

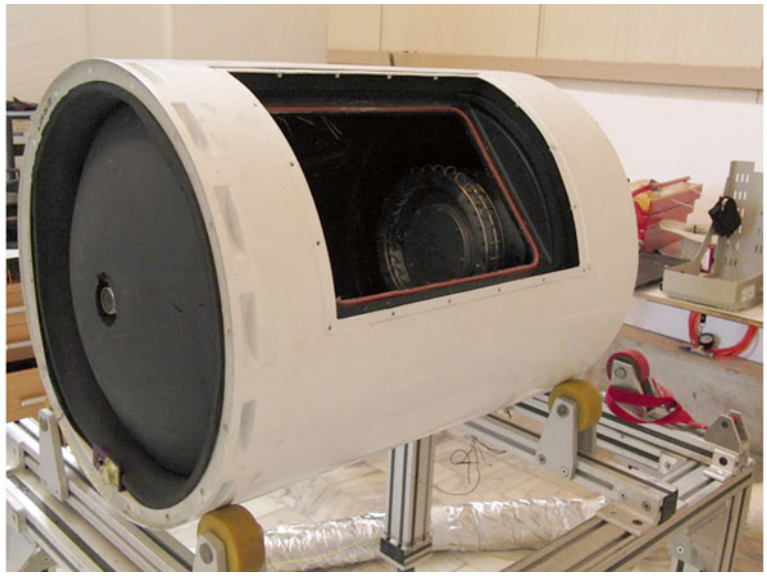
APSCO satellite: Iran is also to implement a satellite project with nine other members of the Asia-Pacific Space Cooperation Organization (APSCO). This organization has defined ten projects on designing, building and launching lightweight satellites, middle class satellites weighing 500-600kg, research satellites, and remote sensing and telecommunications satellites.[337]

Besharat: This satellite, whose name means 'Good News', will be developed with the leadership of Iran in partnership with some members of the Organization of Islamic Conference (OIC), including Turkey, Pakistan, Malaysia and some Arab countries.[338] The launch date has yet to be confirmed.

Muhammad-1: A satellite that is said to be developed jointly by Islamic countries.[339]

8-2 BIO-CAPSULE FOR LIFE IN SPACE

In parallel with Iran's advancements in developing satellites, launchers and other sophisticated space systems and apparatus, and communication and research tools,[340,341] the country has begun practical experiments on life in space by developing a space bio-capsule in line with the plan of the country to send astronauts into space by 2021. The Astronautics Research Institute (ARI), the former Aerospace Research Institute, which works for the Space Research Center of ISA, is in charge of conducting the Life in Space project. The Life in Space Research Group at ARI has been involved since 2002 in the development of bio-capsules in order to perform the studies necessary for Iran to send a human into space.



8.12 Developed by the Astronautics Research Institute of ISA in cooperation with the Iran Aerospace Industries Organization (IAIO) of MODAFL, the Pishgam bio-capsule carried living cargo, the so-called astronaut monkey Aftab, to an altitude of 120km. [ARI]

8-3 SPACE LAUNCH VEHICLES

The development of launch vehicles to place satellites into space was the result of close cooperation between the academic and defense sectors which respectively represented the Ministry of Science, Research, and Technology and the Ministry of Defense and Armed Forces Logistics. But it must be noted that bilateral cooperation with countries like North Korea, China, and the Russian Federation has considerably contributed to the advancement of the plans. After 2000, Iran acquired the necessary skills to begin initial production of the Shahab-3 rocket that was the basis for the development of the nation's space launch vehicles. Availability and access to indigenously developed rockets and launch vehicles has played a key role in Iran's recent leap in space endeavors. To attain this important and strategic goal, Iran has intensively directed its efforts towards its strong desire for self-sufficiency in this arena.

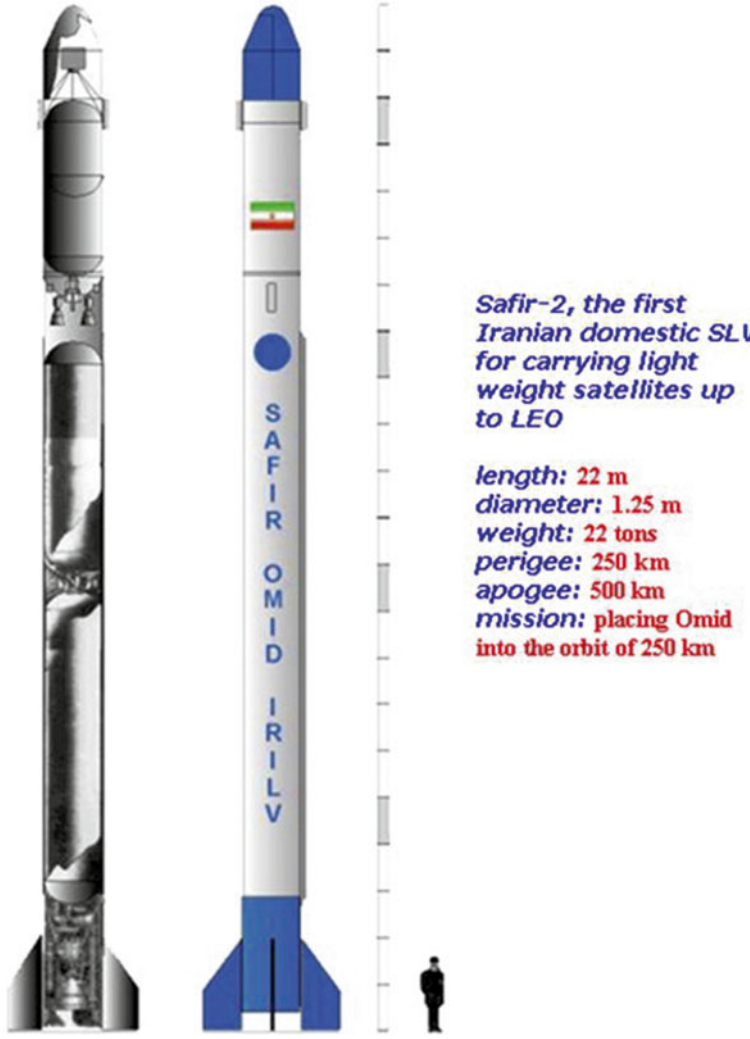
8-3-1 Safir

The first space launch vehicle (SLV) to be developed by Iran was the Safir-2. It was used to orbit the domestically developed satellite Omid. Safir-2 is 22m long with a diameter of 1.25m. It is capable of placing a satellite into an orbit with a perigee of 250km and an apogee of 500km. The success of the Safir-2 is due to experiments and achievements

8.13 On January 29, 2013 the Kavoshgar launcher carried the Pishgam bio-capsule developed by ISA and MODAFL. [Mehr News Agency]

resulting from the successful launch of the sub-orbital rocket Safir (Envoy), more formally named the Islamic Republic of Iran Launch Vehicle (IRILV), on February 2, 2008 from Iran's domestic launch site in Semnan in northeastern Iran. This launch was a preparatory mission for orbiting Omid.[342]

Safir-2 has two liquid propellant stages – a single thrust chambered first stage and a double thrust chambered, step-throttled second stage – and a liftoff mass which exceeds 26 tons. The first stage consists of a lengthened uprated Shahab-3C, a two-stage rocket with liquid propellant engines. The first stage is capable of boosting to a maximum altitude of 68km. The second stage of the Shahab-3C is designed to place a lightweight (50-100kg) payload into 500km orbit. A lighter sub-orbital all-liquid two-stage version of the rocket is known as Kavoshgar (Explorer). It is capable of placing into orbit a maximum payload


SAFIR OMID IRILV
Safir-2, the first Iranian domestic SLV for carrying light weight satellites up to LEO
length: 22 m
diameter: 1.25 m
weight: 22 tons
perigee: 250 km
apogee: 500 km
mission: placing Omid into the orbit of 250 km

8.14 Dimensions and details of Safir-2. [Parviz Tarikhi: 'Iran's space program; Riding high for peace and pride', *Space Policy International Journal* (Elsevier), Issue 3, Volume 25, August 2009, pp. 160-173 (DOI: 10.1016/j.spacepol.2009.05.010)]

of 27kg (the weight of the Omid satellite). Kavoshgar was a civilian derivative of one of at least four known martial anti-satellite weapons (ASAT) systems still in development. Such weapons are designed to incapacitate or destroy satellites for military purposes. The Safir SLV is 40% taller.

The achievement of SLV technology for Safir-2 included system engineering, conceptual design, preliminary design, simulation, detail and critical design, integration and test, and quality assurance. Engine development technology included manufacturing the first stage engine, the development of the second stage engine, and the ability to achieve the

8.15 Safir launch vehicle being prepared to launch the Navid satellite. [Mashregh News Agency]

optimum position and direction for payload release. In structures development, high thermal and mechanical resistances were experienced. Working with propellant technology created the base for the propellant production industries. Development of the velocity and acceleration sensors were amongst the achievements in sensor technologies which also required expertise in application of navigation systems.[343]

According to a joint assessment team consisting of experts from the United States and the Russian Federation that monitors Iran's missile technological capabilities, the Safir SLV and Omid satellite are assessed as having a good degree of technological sophistication. 'By launching an Earth satellite, Iran has demonstrated that it can exploit low thrust rocket motors, build a two-stage rocket, and that it has qualified engineers who are able to make good use of the technology that is available to them. It does not show, however, that

8.16 Safir launch vehicle being prepared to launch the Rasad satellite. [Mashregh News Agency]

Iran has made a fundamental technological breakthrough.' Furthermore, the experts declared, 'The launch of the Omid satellite provides new information about the way in which Iranian rocket technology is developing. Iranian engineers have demonstrated a high level of competence and ingenuity in rocket design.[344]

8-3-2 Safir-1B

The Safir-1B SLV is the second generation and improved form of the Safir-2, capable of carrying a satellite of 60kg into an elliptical orbit of 300-450km. The thrust of the Safir-1B rocket engine has been increased from 32 to 37 tons.

8-3-3 Simorgh

In 2010, Iran developed a more powerful satellite launch vehicle named Simorgh (Senmurw) with a mission to carry heavier satellites up to 100kg into 500km orbits with a speed of 7,500m/s.[345,346] The expendable Simorgh rocket is 27m long, 2.5m in diameter and weighs 77 tons. Its first stage has four main engines, each capable of delivering 29 tons of thrust, plus a fifth engine for attitude control that provides an additional 13.6 tons of thrust. At liftoff, these engines are capable of delivering a total of 130 tons of thrust, which is around four times more than the Safir launchers. The current Simorgh can place a payload of 60kg into a 500km orbit. Its engine could be used in future rockets to place 700kg satellites into 1,000km orbits. The first flight of the Simorgh rocket was to have been in 2013 carrying the Tolou and Zafar satellites into orbit[347] from the Imam Khomeini Space Center in southeastern Iran. However, this launch was postponed. The launch of Mesbah-2 is also expected to use the Simorgh satellite launch vehicle.

8.17 Simorgh satellite launch vehicles. [Wikipedia]

8-3-4 Ghoghnoos

Ghoghnoos (Phoenix) is the new satellite launch vehicle that will be used after the Simorgh SLV for heavier payloads.[348] Sarir (Throne) is another name for the Simorgh's next generation launcher that is on the tongues of the top authorities at ISA, but it is unclear whether this is simply another name for Ghoghnoos.

8-4 GROUND SEGMENT AND DEVELOPMENT OF SITES AND FACILITIES

In addition to space segment technologies, for many years Iran has been developing ground facilities for communications, data acquisition and launchings throughout the country.

8-4-1 Ground stations and facilities

Boomhen, Asad-Abad and Isfahan are ground stations built mainly for communications purposes. The Mahdasht Satellite Receiving Station, whose function was receiving data from Landsat three decades earlier, was developed and included in the greater establishment that became the Alborz Space Center (ASC). The ASC site is planned to comprise the most comprehensive and multi-function ground space complexes as well as the working, living and leisure facilities for Iran's space science and technology specialists, scientists and officials. The majority of ISA's remote sensing activities are presently done by the agency's General Office of the Space Services and Remote Sensing, which is largely located at ASC. There is only one office for remote sensing located in ISA headquarters. There are other ground stations for receiving remote sensing data that are established, managed and controlled by the private sector, universities, and non-civilian sector. ISA is developing ground facilities at several new sites in Tabriz, Isfahan, Shiraz, Mashhad and Chabahar.

The design and manufacture of the Omid satellite kicked off the design and construction of ground stations for a national program of small satellite projects. The first communications command station was constructed in Charmshar, a non-civilian site located south of Tehran. Another was set up in Chabahar, a coastal city on the Persian Gulf. A station for central positioning and control as well as the launch of satellites was built in Semnan. Four positioning stations were constructed in the Province of Sistan and Baluchistan and the Province of Hormozgan, and a station for communications was built in Abadan. These stations include a central station and tracking, telemetry and command (TT&C). The tracking station has the task of tracking the satellite during its launch and then tracking and communicating with it in orbit. The central stations have the responsibility of guiding and controlling the booster rocket, the satellite, and the telemetry. The telemetry and command stations monitor the satellite and transmit commands to it.

Major achievements of the project for establishing ground stations and facilities are as follows:

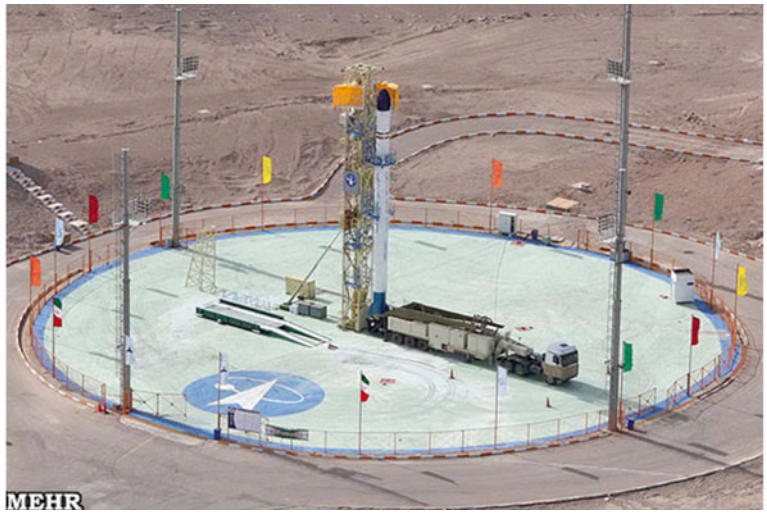
- Acquiring knowledge of the design and construction of ground stations.
- Gaining the capability to develop the required software for ground stations.

- Acquiring the capability to establish communications among the satellite ground stations.
- Developing the capability to establish a secure communications network among the ground stations.

One of the notable achievements in this field is the construction of the first mobile remote testing station. In fact, it is the first indigenously produced receiving station for satellite images. It can receive X-band data from remote sensing satellites at altitudes between 800km and 1,200km. The time for settling and preparing the station for work is two hours, and it has the capability to receive, quickly observe, store, and produce images.[349]

8-4-2 Launch sites

The main launch site for Iran's space program is the Imamshahr Space Center in an Iranian military test range near Shahrood, the capital of Shahrood County in Semnan Province in northeastern Iran. The center was established in 1998 for flight tests of the Shahab-3 intermediate-range ballistic missile, other military tests, and examining sounding rockets.[350] The Ghom Space Center is near the religious city of Ghom, the capital of Ghom Province, some 150km southwest of Tehran. This site is a martial testing range that reportedly has been used for one launch in 1991, reaching 200km altitude.[351] Iran's first Satellite Launch Center is the Semnan Space Center in Semnan Province. It was inaugurated by the launch of the country's first Safir sub-orbital rocket called Kavoshgar-1 (Explorer-1) on February 4, 2008. The facility includes a command and control center, a tracking station and a launching pad, amongst other structures.



8.18 Preparing to launch the Omid satellite from the Semnan Space Center in northeastern Iran. [Mehr News Agency]

Launches by Safir-2 and Safir-1B have provided good experience for launch pad technology in terms of logistics, accessories, transport vehicles, launch tower, launcher integration and readiness testing, propellant charging, and launcher flight control systems. Omid's ground station network, for instance, included three tracking, telemetry and command stations (TT&C), one central flight control station, four ranging stations and the ground receiving stations and terminals. However, owing to the geographical limitations of the first space center in injecting satellites in orbit, late in 2010 Iran set in motion plans to establish a second site.[352] The new national spaceport named Imam Khomeini Space Center is being built in southeast Iran, in the Chabahar area in Sistan and Baluchestan Province. It will be used to launch all future Iranian space missions.[353]

9

Space plans: ambitions, short-sightedness and paranoia

Mid-2005 was the turning point in the political behavior and vision of the Iranian government, whose reflections deeply influenced the space endeavor of the country. This originated on the one hand from an ambitious spirit, and on the other hand the short-sightedness of the highest authorities in directing subordinate authorities that felt obliged to obey. Thus the positive and constructive ideas prior to 2006 of international cooperation in space through manned space flights have been replaced by childish and ill-considered statements about independently sending an Iranian astronaut into space by 2021[354] and to the Moon by 2025 without concern for the prerequisite to develop the necessary infrastructure and capacity. The chancellor of the Sharif University of Technology of Tehran has said that his greatest wish is to hold a collective prayer ceremony on one of the planets.[355] The self-styled dignitaries at the universities and the administrative research institutes of the space agency, who ought to be wise and rational, have never opposed or formally objected to such things. These people are too bureaucratic to prevent the adoption of incorrect strategies. Iran still lacks the basic infrastructure for simple space activities, let alone sending people to the Moon.

The Iranian government provides funding to the academic and non-civilian sectors mainly through the space agency. In the absence of an efficient and thorough auditing system, significant funding has gone astray due to corrupt relationships that engaged in embezzlement. Unsurprisingly, therefore, the talented, knowledgeable and enthusiastic Iranians who have been rejected, banished, or expelled in a variety of ways, have seized upon opportunities provided by other countries that respect their talent, interest and courage in seeking to prevail. Meanwhile, the ruling authorities of their original country weep crocodile tears for the banished dignitaries and the talented elites.

The most amazing thing about the management of the Iranian space endeavor is that since 2006 there has been no real separation between ambitions and delirium, which are emerging in a mixed fashion. This substantially reflects an effort for hegemony and control, and space technologies are the chosen means to attain that goal. However, from the viewpoint of the technocracy in Iran, the ambitions promote national pride and respect, the things that the society and technocracy has sought for decades and maybe even centuries. Nevertheless, the shortsightedness and paranoia are annoying and disappointing

P. Tarikhi, *The Iranian Space Endeavor: Ambitions and Reality*, Springer Praxis Books,
DOI 10.1007/978-3-319-05347-9_9, © Springer International Publishing Switzerland 2015

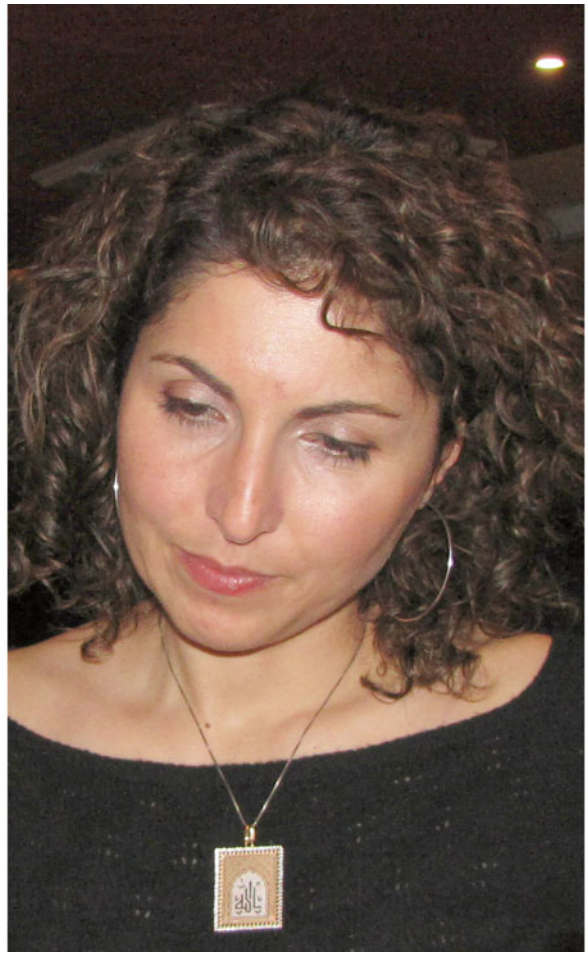
to the technocracy. Like a dormant fire that flares from the ashes, the technocratic young generation in Iran will one day have the final word by removing the shackles from the Iranian space endeavor.

9-1 SPACE TOURISM, AN IRANIAN IN SPACE AHEAD OF IRAN

It is perhaps impossible to confine human will but it is the perverse desire that it is always defeated, according to what human history testifies. Although the contribution and the attention of Iranians to explore space has been considerable since ancient times, not everything in this regard occurred in the past; there are many examples involving contemporary Iranians. One is a brave Iranian woman who realized her dream of going into space. This Iranian-American astro*preneur* and telecommunications tycoon businesswoman reached space ahead of Iran. Anousheh Ansari was born in Iran in 1966 and spent her childhood there dreaming of venturing into space. In 2006 she realized this ambition when she boarded a Russian Soyuz spacecraft and became the fourth space tourist, and the first woman of that small elite. Wearing both American and Iranian flags on her spacesuit during training, she stated that she wanted to recognize both countries' contributions to her life.[356] Having paid an estimated US $20 million, she flew to the International Space Station as part of a crew-exchange mission that was launched from Baikonur in Kazakhstan on September 18, 2006 and landed safely in that same region on 29 September.[357]

The narrative of the journey of Anousheh Ansari into space and the way in which it happened has many things to teach us, and is an indication of tremendously exciting, wonderful and important facts that are undeniable. That an Iranian succeeded in traveling into space despite the many obstacles that she faced in her childhood and teenage years in Iran is inspiring. It is an indication of how the system in Iran retards the enthusiasm and high intentions of Iranian individuals, particularly the young. What Ansari achieved and the way that she did it is the dream of countless Iranian children, teenagers and young people. As Ansari describes in her book *My Dream of Stars - From Daughter of Iran to Space Pioneer*, which she wrote together with Homer Hickam, the inception of the new government in Iran after the revolution in 1978 was followed by the establishment of a new military organization called the Revolutionary Guards [Guardian Corps of the Islamic Revolution]. She refers to the members of the Guard as arrogant boys without much education, with whom she learned not to make eye contact. About her future Ansari points out, 'As graduation from high school neared, I started to become more and more concerned about my future. My love for the stars had led me to decide that I wanted to be an astrophysicist. But, how would that be possible? The new Iran did not encourage higher education for women.'[358]

In the preface of her book, Ansari writes, 'Call this a love story that ends not only with an embrace but a fortune gained, a dream fulfilled, and a voyage to the far and magnificent reaches of space. After everything was done and I landed beneath silky parachutes on the high desert of Kazakhstan, I realized it wasn't rocket engines that had propelled me to the stars but the infinite power of hopes, dreams, and especially love, which transcends everything, even the universal principles of physics.' She goes on to say, 'When I was in space, I felt free of all the trivial details that can preoccupy the minds of humanity daily. I had been blessed to not only dream of the stars but also to be visiting them.



9.1 Anousheh Ansari was the first Iranian astronaut. An astro*preneur* and telecommunications tycoon businesswoman she paid an estimated US $20 million for a 10-day journey to the International Space Station in September 2006 onboard a Russian Soyuz spacecraft launched from Baikonur in Kazakhstan. She was the fourth space tourist, and the first woman amongst them. [M. van Eijkeren]

But even in space, I was aware that the light of our tomorrows is sometimes threatened by the darkness of our yesterdays.'[359]

Ansari's belief that there is always a way to make even the most impossible dream come true is a valuable point from which she gets her energy and motivation. In her book, she says her love of the stars was inspired by her favorite book, *The Little Prince,* which is written by and about a pilot whose plane crashes in the desert. There he encounters a little boy, a prince from a distant planet. When the prince begins to talk about how beautiful his planet is, the pilot is surprised. As Ansari relates, 'most people who read [this] book identify with the pilot, but I identified with the lonely prince who missed his home planet.'

She continues, 'One part in the book I particularly liked was when the little prince traveled to a planet occupied by a businessman who claimed ownership of all the stars.' Quoting from the book, she reiterates the question asked by the prince, 'What do you do with them? [Planets]' and the answer of the businessman is 'Nothing, I own them.' Ansari adds, 'The reason the prince told the story was because he wanted everyone to know the businessman was wrong. He didn't own the stars at all because he didn't know what they were for.' She then concludes, 'Even as a child I thought I knew. The stars were a place of escape where nothing was sad and everything was beautiful.'[360]

The reason and motivation why she was forced to leave Iran for the United States of America and then succeed in traveling into space all originated from the bigoted vision of the arrogant people who have prevailed in Iran during recent decades. The situation is very similar to what happened to Firouz Naderi and many more, some known and others unknown. Although Ansari traveled into space after leaving Iran – developing her business in space exploration, space tourism, and space entrepreneurs abroad – she should be considered an important component of the Iranian space endeavor like many other Iranian men and women who are enthusiastic about space and space technology development, and work in this field. In her book she refers to an expression that was written on her mission patch: 'Imagine, Inspire, be the Change'. If we cogitate, we see the manner in which she has succeeded in imagining, inspiring and changing the world in general and her native land in particular.

Of her flight to the International Space Station, Ansari says, 'My trip would not have been possible without the support of the Russian Space Agency and NASA. I admire all the great men and women who work at both of these agencies for their passion and dedication to space exploration.'[361] Prior to her mission, the Iranian Space Agency, in administrative charge of all space-related activities in the country, and the Aerospace Research Institute of Iran in separate announcements praised the flight of the first Iranian space tourist and expressed wishes for her success.[362,363] But after her return to Earth, and in spite of the public delight and sense of honor for her achievement, the official reflections were unbelievably mixed.

9-2 LIFE IN SPACE AND SPACE JOURNEYS

Iran's leaders and authorities show great enthusiasm for the dream of traveling and living in space. In the ceremony in Tehran to commemorate Space Technology Day on February 4, 2013,[364] the president of the state Mahmoud Ahmadinejad announced his readiness to be the first Iranian astronaut to travel into space despite its risks; it is not known whether he was joking or serious. Despite the fact that the first Iranian tourist, Anousheh Ansari, journeyed into space and resided aboard the International Space Station in September 2006, Ahmadinejad quipped, 'I'm ready to be the first Iranian to be sacrificed by the scientists of my country and go into space, even though I know there are a lot of candidates.' As a further indication of his devotion to the progress of the Iranian space endeavor, he claimed that he was willing to 'auction (himself) and to donate' the proceeds to Iran's space plan.[365] However, Iran's plan for manned space flights derives its methodical basis from the will of the country and its leaders and authorities for the benefit of the nation and humanity.

9-2-1 Manned space flight

The idea of sending a human into space has been raised frequently by top authorities in Iran in recent times. In his opening remarks of the 10th Conference of the Iranian Aerospace Society held on March 1-3, 2011 at the Tarbiat Modarres University of Tehran, Hamid Fazeli, the head of the Iranian Space Agency, believing that the space power of a country is realized only when it manages to send humans into space, stated that only three countries had attained this capability. He added that based on the IR President's order that a human should be sent into space by 2021, the necessary studies and programs for sending people to space and the Moon had been started. 'In the framework of the first Five-Year program of sending humans into space, we plan to send and retrieve an astronaut to a height of sub-200km,' he announced. However, the success of this plan would clearly depend on the space agency receiving the necessary financial support from the state.[366]

In fact, the background of Iran's manned space flight program actually goes back two decades. The country revealed its intention to send a human into space on June 21, 1990 in the course of the summit of Iran and the Soviet Union. Soviet President Mikhail Gorbachev reached an agreement in principle with President Akbar Hashemi Rafsanjani to carry out a joint Soviet-Iranian manned flight to the Mir space station. The dissolution of the Soviet Union shortly thereafter put this agreement into abeyance. But in November 2005 ISA declared a plan for the development of not only a manned spacecraft but also a space laboratory. On August 20, 2008 the third president of the space agency announced Iran's plan to launch a manned mission into space within a decade in order to make the country the leading space power in the region by 2021.[367,368] Iran's continued intention to benefit from the experience and achievements of the leading spacefaring nations, notably the Russian Federation, in the framework of joint manned space flights and implementing research projects in space is promising and shows that Iran's interest in international cooperation in the space arena is worth strengthening and supporting. Such an idea was emphasized during the meeting at ISA headquarters in Tehran on April 12, 2011 to celebrate International Astronaut Day, the 50th anniversary of the first human flight into space. The ISA president reiterated that, owing to the long-term involvement of the space agency in the peaceful uses of space technology, Iran was ready for bilateral cooperation. The ad-hoc invitee to that meeting, Alexander Sadovnikov, the Ambassador of the Russian Federation to Iran, stated that the cooperation between Iran and the Russian Federation in space technology that was started 20 years ago continued, despite some problems. 'Iran's recent successes in the field of scientific space research shows that not only Iranian astronauts will be sent into space in the near future but also Iranian space technologies, in line with the technologies of other spacefaring nations, will be used.' Both countries were interested in establishing an atmosphere of scientific and technical cooperation in the field of space, free of political considerations.[369,370] As Sadovnikov put it, 'It would not be the matter of my surprise if I witness that someday in the International Space Station Iranian scientists would work and do research along with scientists of the other nations.'[371]

9-2-2 Animals in space; Iran's monkey business

In accordance with the goals announced by the Iranian authorities, in 2009 the space agency began to use primates on flights and in associated research. Despite several failures, the

most recent of which was in 2011 and led to the death of the primate on the Kavoshgar-5 rocket,[372] Iran announced that it would continue this effort. In relation to the plan to send a live monkey into space early in 2013 the president of the space agency confirmed the implementation of the test program using a bio-capsule to accommodate a monkey. He explained that the monkeys were intended to be sent into space according to a timetable on Fajr Ceremonies that refers to a 10-day period in the beginning of February when the Iranian revolution is commemorated. The success of the mission was presumed to advance Iran's goal of sending a human into space by 2021 and an astronaut on the Moon by 2025.

9.2 This monkey was very likely flown into space onboard the Kavoshgar-5 rocket in September 2011. However, the mission was a failure and the monkey died. After further development, the Iranian authorities announced on January 29, 2013 that a living cargo was sent into space and returned safely aboard the Pishgam bio-capsule launched by a Kavoshgar rocket after having reached an altitude of 120km. The images of the above monkey emerged in the official released news-propaganda footage and other reports related to the flight, prompting suspicion concerning the success and genuineness of the Kavoshgar-Pishgam mission. [Mehr News Agency]

Iran launched Kavoshagar-3 (Explorer-3) on February 3, 2010 carrying a rodent, two turtles, and several worms into sub-orbital space and returned them to Earth.[373,374] The data and live footage that were transmitted back to Earth showed a mini-environmental lab to enable further studies on the bio-capsule. As the first biological payload launched by Iran, it ranked Iran as the sixth country to send animals into space. On March 15, 2011, Iran launched Kavoshgar-4 (Explorer-4) with a test capsule designed to carry a monkey, but without a living cargo.[375] Kavoshgar-5 (Explorer-5) carrying a live monkey was launched for a 20-minute sub-orbital flight in September 2011. The mission failed and led to the death of the monkey. On October 3, Iran postponed further plans while scientists reviewed readiness for future missions. In May 2012 Iran announced that it would send more living creatures into space by the summer. The authorities announced on January 29, 2013 that a monkey had been sent into space and returned safely aboard the Pishgam capsule after reaching an altitude of 120km; the first time that Iran had sent a primate into space.[376]

Although the authorities in charge of space in Iran are of the opinion that monkeys are so similar to humans that flying them in space allows human issues to be studied, the leading spacefaring nations do not. Iran's tests have raised global as well as domestic objections, in particular by the international People for the Ethical Treatment of Animals Foundation (PETA)[377] and by the Iranian Society for the Prevention of Cruelty to Animals (Iran-SPCA).[378] The space authorities in Iran regard such criticism as the general enmity of the world community toward the country's space program. However, learning lessons from the experiences of other spacefaring nations is wise. Clearly, 'the beaten road is safest.' Avoiding the mistakes of others will save a lot of time and money for Iran.

In the early days of spaceflight for the United States and the Soviet Union, animals were used to test the viability of sending a living creature into space and returning it safely. The use of animals in this manner is not a sign of technological progress, but a throwback to the primitive scientific ethics and techniques of the 1950s in which cruelty to animals was not a major issue. The history of space exploration is tainted by wasted lives and terrible deaths of animals – from Russia's first space dog Laika, who was baked to death in her capsule, to hundreds of chimpanzees and other primates who were pointlessly tormented by NASA over decades. A rhesus monkey named Albert-I was the first ever monkey astronaut. It was launched aboard a US military V-2 rocket from White Sands in New Mexico in June 1948 but suffocated and died in flight. A monkey named Yorick was the first to live through a space flight. Yorick and 11 mice were recovered after an Aerobee missile flight to 70km from Holloman Air Force Base in New Mexico in September 1951.[379]

In 1950, after mice and rabbits, Russia put nine dogs into space. In 1963 France joined the USA and Russia by sending a cat into space. In addition to being unethical, animal experiments produce results that cannot be reliably applied to human beings. From the technical viewpoint for manned space flights the reentry into the atmosphere is crucial, particularly for beyond sub-orbital missions. Furthermore, the psychological factors are more important and critical than the physiological factors. It is probably impossible for animals to imagine and to understand what could be the experience of travel into space. It is basically and substantially different for human beings. The psychological and mental factors in the case of human space flights play the key role, and inevitably and

considerably influence the physiological behavior, reflections and procedure of a human traveling into space. Due to this inapplicability, the results cannot really be extrapolated and could even endanger the human astronauts. NASA terminated the use of primates in space radiation experiments in the early 1990s when it was realized that the results were not relevant to humans. The European Space Agency uses state-of-the-art human manikins with sophisticated sensors to assess the radiation risks for astronauts.

It is indeed pitiful that Iran repeats the mistakes of the early space programs. In an announcement, released in the last days of January 2013, the news about the launch on January 27 of the Kavoshgar rocket with the Pishgam bio-capsule onboard was distributed by the local media. The media poorly related the fact that Iran had sent a primate into space. Several days later, the authorities decided to release the news more widely. This was unusual compared to the earlier launches that claimed to be successful. The functions for preparing the primate – for which US $1 million was expended – were reported to have been carried out primarily in and by the non-civilian Iran Aerospace Industries Organization in cooperation with the Astronautics Research Institute.

10

Breaching the principles and ethical crisis

The ongoing events and happenings, some of which were discussed in the previous chapters, bring to mind many questions. What was the motivation behind these deeds? And who were they designed to serve? Perhaps a comprehensive discussion of this topic requires access to more details, documents and references. However, the author witnessed many things, especially since 2005, and can offer a sample of what was going on. The situation can be inferred from the saying, 'You may know by a handful the whole sack.' The lack of wisdom and the development of corruption in recent years is unprecedented in the entire history of the Iranian space endeavor, and actually should be referred to as a period of imposture and dissimulation. It led to the emergence of managers at the top like Ahmad Talebzadeh and subsequently Reza Taghipour, Muhammad Ali Forghani and Hamid Fazeli, and the corruption and evil that they instigated was no doubt endorsed by the middle and low rank managers and officers such as Muhammad Mehdi Salehfard, Muhammad Izadi, Muhammad Hassan Entezari, Mehdi Tabeshian, Mohsen Rezaie, Muhammad Jaafar Muhammadi, Saman Jalayerian, Rahmatullah Khazaie, Hussein Suleymani Isfahani, amongst many others.

10-1 COMEDOWN AND DECLINE

The only legal thing about ISA is that its establishment and statute was approved by the parliament of Iran in 2005. According to that statute, the agency is affiliated to MCIT as an autonomous agency and is mandated to work under the SSC headed by the President of Iran. This status was changed in 2008 with the approval of a new statute. According to this statute ISA remained an autonomous body under MCIT but was no longer mandated to work under the SSC because the council had been dissolved by the President of the state in 2007. The legitimate reestablishment of the SSC would require the explicit approval of the parliament, and this has never been sought. Indeed, the dissolution of the SSC in 2007 was the main reason for parliament approving the statute in 2008. Based on the 2008 statute, which is still legitimately in force, the ISA president is the only person responsible for making decisions about space-related issues. Annexation of ISA to the Presidential Institution is another issue that needs to be approved by the parliament; it is not officially

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legitimate, but it has happened. To put it simply, since the annexation of ISA to the Presidential Institution all the activities carried out go on illegally. ISA's president should be appointed by the Minister of Communications and Information Technology. The SSC cannot convene and make decisions, since it does not exist legally. And since the 2008 statute it is illegal to rely on the decisions made by the SSC. The long-term consequences of ISA operating in this manner remain to be seen.

The turmoil in legislation and administration of ISA, and the absence of informed managerial and executive control on its activities, decisions and strategies, has exposed Iran's civil space endeavor to incompetent and unskilled authorities. This turmoil and corruption derives from the vision of the non-civilians ruling the agency that says, 'everything is purchasable'. This great perversion has destroyed the high values and steps that should be taken for the proper development of space technology in the country. The unspecified and yet unlimited authorization that the ISA president was provided with by the second statute of the agency was the principal reason for the subsequent corruption and turmoil at the agency. Possibly, it could be argued that this deterioration was the result of the pressures imposed from abroad, and the bans that the world community imposed on Iran. But if this was the case, it can definitely be stated that this international pressure has led to the widespread corruption in Iran, a part of which is the space endeavor.

The entrance of non-civilians to the civilian domain of the Iranian space endeavor was an awful development that has hindered the country's efforts to pursue the peaceful uses of space technology. As was said at the beginning of this book, the attitudes and visions of the leaders and the authorities influence and contribute to the pace, progress, and developmental objectives of the space program in each country. The new managers at ISA lack a tangible and realistic vision about the issues they are involved in. Their poor education and knowledge, despite holding official high academic degrees, and lack of practical experience are further reasons for their ineligibility to hold such responsible jobs. In just a few years, these non-expert and poor quality managers and decision-makers have engulfed the agency in the kind of corruption that they had been pursuing elsewhere for more than three decades.

Just as the establishment of ISA institutionalized space-related activities throughout the country, the appearance of the non-civilians in the agency institutionalized the corruption. Perhaps a move in the opposite direction could retrieve the soundness of the space administration? Militarization was an effort to empower the non-civilians entering the administration and their use of the reputation of the agency to attain the non-peaceful and security purposes that inevitably led to non-humanitarian and corrupted commitments to pursue ominous and devilish goals. Unfortunately, as in the early decades after the revolution of 1978 in Iran, personal and ideological loyalty mixed with imposture is again being valued over competence. In the course of the activity of the agency during the recent decade a new unjust employment system has been operating. Using this patrimonial employment system, the offspring of an employee can take the place of a retiring elder so long as the authorities of the agency allow such a substitution. This is gradually influencing official positions at all levels throughout the country. By opening doors for the expansion of corruption in society, it threatens the security of the citizens mentally, socially, financially and physically.

It is evident that the functions and structure of the work of the Space Research Center of Iran are based on only space technology development, and that research for developing

applications is being neglected. One possible reason for this bias derives from the nature of the research institutes which were joined together to form the Space Research Center of Iran. Those included the Space Research Institute (SRI), the Aerospace Research Institute (ARI) and the Engineering Research Institute (ERI). Knowing the structure, background, and configuration of these so-called research entities is essential, since that information will shed light on the aims of the institutes and will expose the reason for the discrepancy in this connection. Is it wise that an engineering unit that for years has been involved in issues such as designing processing systems for dairy, starch, and food, as well as the irrigation and drainage facilities, agricultural machinery, etc., should be attached to a space agency mandated with entirely different functions and duties? Could the staff, workers and personnel of an engineering unit suddenly become researchers? The result could hardly be promising. Would it not have been better to create a new entity with a relevant organization staffed by competent researchers and personnel? The expense and effort to establish a new entity would certainly have been less than that which has been expended in affixing such futile institutes to the agency. It is not wise to even surmise that aspiring to bigger achievements such as conquering the Moon would justify such inanity. It is a false tradition in Iran that, for example, a tutor or anyone presenting lectures in a university is called a professor just to be respectful, irrespective of whether the person has the qualifications and accomplishment of being a university professor by global standards. The same applies to research. A person who holds a master's degree or higher in any career is considered to be a researcher and is included in the official statistics. On this basis, Iran has many researchers. They are presumed to be qualified to work in any institution with a substantial function of research or scientific work. It is on this basis that the research institutes employ their staff. As a result, the institutes fail to attract genuine and talented people. The result for the institutes is entirely predictable.

Due to the authority assigned to the ISA president by the establishing statutes, the presidents of the agency have played key roles in its destiny. Hassan Shafti, the first president of the agency, alarmed at the recent deterioration of the agency, has served as an advisor to the fifth president since September 2010 in an effort to overcome the deeply rooted corruption. In terms of education, instruction, social background and status, the last three presidents have had closed minds and a lack of vision, have been suspicious of everyone, and have eagerly sought to accommodate their superiors in government. The main causes of the decline in the quality of the space endeavor were severe managerial weakness and lack of attention to the competencies in the country. Official rents, and all manner of the privileges are offered to those settling into the inner realms of power and managerial authority at the agency. They are routinely paid for work which they haven't actually done. This has led to the emergence of a type of low-class aristocracy among the neo-non-civilians and security sources who deem themselves to be capable of taking control but remain ignorant of the implications of their real neglect of the situation.

Of the ISA presidents, only Shafti was deserving of respect and admiration. His successors have lacked the scientific and managerial eligibility to carry out such a responsible position. Shafti was a genuine technocrat and manager. In recent decades, the number of gentle managers like him in Iran does not exceed the number of the fingers of a couple of hands. His role in the history of the Iranian space endeavor resembled the glow of a meteor in the darkness of ignorance held by his successors. The author is proud to have worked

with him during the course of his presidency at the agency and in the ensuing years. The behavior of the presidents of the agency broadly followed the policies which were being pursued by government and state authorities. After 2006 their behavior became explicitly unethical and deceitful. The most unpopular ISA president (the second) and its most offending (the third) were, between them, chiefly responsible for the decline of the civil space endeavor. The space endeavor has not been immune from the increasing corruption in the country. The admission of non-civilians led to stealth and security at the agency, a situation that the second president exploited very effectively. During the terms of the third and fourth presidents for example, correspondence with the top authorities of the agency were often considered from a security point of view, with investigations conducted by security agents. This procedure was moderated somewhat during the term of the fifth president of the agency, but not stopped. For instance, from August 2008 to October 2011 the author was summoned or chased by the agents of the Ministry of Intelligence for questioning 20 times. His family also received suspicious threatening calls in the course of that period. After the annexation of ISA to the Presidential Institution, the security pressure multiplied. The agency, like the state itself, has spent a large amount of money on security measures, but most of this expenditure has been to no avail. This has opened the way for both small pilfering at low level and large scale embezzlements at higher levels by top authorities, and state and official rent-seeking. In the years after 1979, excluding some exceptional cases, the top authorities and managers of first the Iranian Remote Sensing Center and then the Iranian Space Agency were the primary beneficiaries of state rents and other privileges. The advancement in their careers is owed to those opportunities that were exclusively offered to them or reserved for them. The nature of their advancement is quite different from their predecessors in the years prior to 1979. While Farshid Jahedi, Ahmad Talebzadeh, Ali Asghar Amidian and many others benefited from their privileges, the impact of their deeds and maliciousness on the Iranian space endeavor became clear for all to see.

Nevertheless, it must be recognized that both the political and economic pressures that Iran has suffered since 2005 were much more severe than in the preceding years. This is linked to the policy and vision of the rulers that interact with those of the world community. Before 2005 a positive and constructive vision was held by the authorities and there was a relatively more open environment in the country that allowed productive and positive international interactions. It was not ideal but it was clearly more promising than the situation that followed. The Iranian space endeavor dates to the dawn of the Space Age. In the course of half a century, good and promising sources in terms of specialists, scientists, engineers, and managers in space-related fields emerged in Iran and stimulated the growth of the endeavor. The country's recent success in space derives mainly from that asset. However, the complexity of space activities, at least in the current era, really requires cooperation and collaboration at international, regional, and bilateral levels. The pace of activity is affected by economic, political, social and other parameters such as knowledge.

It is notable that since 2006, the space agency's international relations office has withdrawn from the important role of a specialized international cooperation arm, having operated continuously since the establishment of the agency and even prior to that. The agency's international interaction in recent years has been reduced to diplomatic issues, and this was pursued mainly by the Ministry of Foreign Affairs. Diplomatic issues are not at all the business of agency's international affairs office, however. It should carry out its

principal and specialized international cooperation functions by absorbing and employing experienced and able technical and scientific experts capable of operating internationally. The retrograde visions held by the top authorities of the agency were so terrible and unpromising that the third president of the agency believed the goal of international participation should be to repel the evil intents of other countries. He adopted this vision in the early days of his presidency and urged his experts and engineers to develop satellites and nuclear technology as a means of enabling the Shiites to predominate over the globe.[380]

In recent years, almost all of the previously positive international policies and plans of the agency have been either reversed or put into abeyance. The content and attitude of specialized international cooperation fell to its lowest level during the term of the second president of the agency. For example, participation in the UN-COPUOS (United Nations Committee on Peaceful Uses of Outer Space) and STS-COPOUS (Scientific and Technical Subcommittee of COPUOS) was repeatedly restricted. After being criticized for placing limitations on the country's delegation and the COPUOS Bureau member in the COPUOS and STS-COPUOS meetings, the president of the agency authorized very limited and shortened participation of Iran's member in the COPUOS 2007 meeting. This was in response to OOSA (Office for Outer Space Affairs) calling on Iran to send its COPUOS Bureau member to the meeting. The country was criticized for imposing limitations in this connection, a fact that was reflected in the relevant reports of that time.[381] Iran therefore failed to play the role it previously earned in COPUOS deliberations, missed out on chairing and conducting Action Team No.1 of the Recommendations of UNISPACE-III properly, and failed to contribute to the work of other action teams. In the meantime, the goals of Iran in contributing to UN-ESCAP (United Nations-Economic and Social Commission in the Asia-Pacific Region) and AP-MCSTA (Asia-Pacific Multilateral Cooperation in Space Technology Applications) were defeated. As a result, decisions about Iran's proposal for establishing the center for informed disaster management were placed into abeyance. The country's role in the interim committee for establishing APSCO (Asia-Pacific Space Cooperation Organization) also faded as a result of poor contributions to committees. And finally, in COPOUS, Iran's aspirations for the UN-SPIDER (United Nations Platform for Space-based Information for Disaster Management and Emergency Response) program were reduced to actions at the domestic level.

As was witnessed by the author, the dismissal of the second president of the Iranian Space Agency on July 24, 2008 was a happy occasion for the majority of the personnel and staff. Although more or less expected, it was an unprecedented event at the agency. Most people hoped that it would end the nightmare. During the course of Talebzadeh's presidency, neo-non-civilians and security officers entered the agency and took most of the top positions, especially the top managerial positions. His term in office was the transition phase for the civilian space activities in Iran, because they were fully confiscated by the non-civilians when Taghipour superseded Talebzadeh. Moreover, Talebzadeh's dismissal only nine months in advance of the 10th presidential elections in Iran in June 2009 raised the idea that he had been expelled owing to high corruption and explicit mismanagement. Prior to becoming ISA president, Taghipour had held the position of deputy director general of the Iranian Electronics Industries Company (SAIran), affiliated with the Ministry of Defense and Armed Forces Logistics. Unfortunately, the happiness of Talebzadeh's dismissal was dashed by the manner in which the neo-non-civilians completed their takeover, turning the agency into a type of garrison in which non-civilian managers and other

low ranking officers came daily to work wearing plain coats. About two months before Talebzadeh's dismissal, the author was summoned by him. At the headquarters, I met him in his office. He spoke ironically, using contradictory words and ideas. There was a letter in his hands from the Ministry of Foreign Affairs demanding that he dispatch me to the COPUOS-51 meeting at Vienna. He was trying to cover the letter, but let me see it shortly. He did not talk about that letter, which remained on his desk intact. But his behavior sent a clear message: 'Although the Ministry of Foreign Affairs is interested and urges that I dispatch you to Vienna, I will not allow you to attend that COPUOS meeting as Iran's delegate.' Consequently, the author was not authorized in this connection in subsequent years. This occurred only once, in February 2012, after five years. It is worthy of note that about a month after meeting Talebzadeh, I received a phone call from Reza Pourmand Tehrani, the Deputy Ambassador of Iran's Mission to UN-Vienna, on Wednesday, July 23, 2008, who alerted me to Talebzadeh's imminent dismissal. At that time, I was still the main expert member of Iran's delegation to COPUOS and other international forums. Tehrani ambiguously told me that I might be investigated but it wasn't clear to me what he meant. In the year after this phone talk, I was investigated no fewer than five times by the Ministry of Intelligence and my banishment status at the Mahdasht Satellite Station continued. This is a sample and an indication of how irresponsible, unwise and immature the presidents and top authorities have been in dealing with the issues and important matters of the agency's functions and programs, as well as its agenda.

The clandestine atmosphere prevailing at the agency was made even worse by the takeover of its third president, particularly because of the vision that he promoted. Intimidation, menace, inquiring, inquisition and rascality, mainly initiated by the top authorities who ruled the agency, became the common means of implementing issues and dealing with staff. The author, for example, requested a meeting with the president in the early days of his tenure. A few hours before the meeting was due, I received a suspicious phone call from an unknown person, urging me to deliver my passport to the passport office. While this sounded bizarre, after verifying the issue it was revealed that the second president had a hand in the plot, as his secretary disclosed unwillingly. The presidents of the agency have been involved directly with the pressure and intimidating plans. A month after this mysterious event, I sent a letter to the president of the agency, including a copy of an article that I had just had published in a foreign periodical. The next day, I received a telephone call from an unknown person urging me to go to the SAIran building in the north of Tehran. When I asked for a reason for this, I was told that I should do what I was ordered without any question. I went to the SAIran building the next day. Two people investigated me there for hours. They introduced themselves as officers of the Ministry of Intelligence and National Security. They were concerned about my activity in COPUOS, they said. My further verifications convinced me that these things had been initiated by the second president of the agency. The inquisitors ordered me to meet them a week later with a detailed report and explanation. As instructed, I went to room 811 of the Hotel Homa in Tehran and had a boring investigatory meeting with one of those officers lasting about four hours. That was exactly the time when the UN-SPIDER Workshop opened on Monday October 6, 2008 in Tehran, thus I, as an invitee, missed the meeting. What caused my surprise in the course of the investigatory meeting was the intelligent officer considered Ahmad Talebzadeh and Saman Jalayerian to be of questionable importance, as if both men were in dummy positions at the agency.

10.1 The members of ISA's delegation (circled) to the NARSS/ISNET Seminar on Bridging the Gap through Satellite Technology, held on October 18-21, 2010 in Cairo, Egypt. None of the delegation members was genuine staff of ISA at the time of the seminar. Number 1 is Muhammad Ali Forghani, the non-civilian fourth president of the agency who was dismissed twenty days before the seminar. Number 2 is the martial officer of the Guardian Corps of the Islamic Revolution, Rahmatullah Khazaie, who was assigned to ISA. Number 3 is Saman Jalayerian, an officer of the Communications Regulatory Authority which is MCIT's watchdog organization, who was assigned to work at IRSC and ISA. With dummy positions at ISA, they attended the expert seminar, stealing the opportunity from the eligible specialists and experts of ISA and the country. [ISNET]

As with the development of security conditions in the country as a whole, the number of security people at the space agency continues to increase. Indeed the technical officers and experts are now overwhelmed by janitors, security, and intelligent agents. Many funds are expended for the security officers. They interfere everywhere and in everything. They libel anyone that they wish. They are numerous in the delegations that attend foreign and international meetings. The authorities of the agency give them priority because the authorities themselves originated from that class in society.

In mid-August 2009, the president of the space agency, Reza Taghipour, was nominated as the Minister of Communications and Information Technology. Since he was a member of the Guards, his appointment launched the confiscation of that Ministry by them. The non-civilian newcomers started to destroy everything and divert the efforts to their own band and personal benefits and interests. They kept and offered the top positions only to those who substantially were security officers or members of the Guards commissioned to work with ISA affiliated with the Ministry. By militarization of the Ministry of Communications and Information Technology, security, control, and spying on citizens became the Ministry's main duties, and it became a tool for jamming satellite TV broadcasts. As a result of the change in the orientation of MCIT, the situation at the space agency became even worse.

10-2 MISUSES AND DECEIT

The global criticism of the second president of the Iranian Space Agency was a surprise. The reason could be that during his term in office the agency began to transition from an almost healthy civilian system to a rotten entity. He opened the space agency to non-civilians, and never defended the spirit and aims of the agency as an entity mandated to use space for peaceful purposes and the welfare of the nation. It was a matter of great shame for him to misuse his authority and trample the high values and will of the people to whom he was indebted.

From its early days the agency encouraged active links with the universities for capacity building. This was fulfilled with a number of leading universities developing student small satellites. Although this is the positive and more or less popular face of the issues, in the recent octennial period there has been an ugly face. The words 'student satellite' do not indicate that the satellites were designed and handled by university students. Using the attribution of 'student' is an effort to hide something, particularly for political reasons, from the attention of the people. Indeed, it is a form of demagogy. Its political abuses are very common in Iran. Under the name of 'university students' the pressure groups occupy embassies, attack meetings and gathering, and do what is unfavorable in the opinion of the public. The so-called student satellites, which would be better referred to as 'academic satellites', were not designed or manufactured by genuine students. It is a means for the authorities to operate without any responsibility for being audited and investigated by the open-minded, open-eyed and careful citizens and perhaps the world community.

The presidential elections of 2009 and the events that followed were the beginning of the broader presence of neo-non-civilians at the space agency. For the people working in the agency, this was a coup by the non-civilians and the occupation of the agency by them.

Only the guns and tanks were absent. Nevertheless, the martials were at work, confiscating everything for self-benefit. From behind the agency's mandate to use space and space technology for peaceful purposes they have turned it into a showcase for their non-peaceful ambitions. They desired the compliance of the people working at the agency. Those who would not compromise were rejected and cast to the margins. Since then there has been a serious challenge between the genuine and noble technocrats at the agency and the invaders that seek to use space technology as a tool for control, menace, demagoguery and deception. A never-ending stream of non-civilians in plain clothes and other civilians visit the ground facilities, particularly the Mahdasht Satellite Receiving Station because of its historical role in the inception of the applications of space technology and remote sensing in Iran. By making these propagandistic visits the non-civilians show off their power and presence all around the country with verisimilitude.

Management has been a vital component in the success or failure of the Iranian space endeavor in different eras of its history. Success, prosperity and respect came when management was carried out wisely; when it was contaminated with bigotry, the endeavor went astray. As a result, in the monopoly and individual-centered system of the agency it is essential to know the personalities, mentalities and characteristics of top managers in order to understand their degree of commitment and how they wish to carry out the space endeavor. Apart from the first president of the agency, all of his successors have believed that the agency was their personal asset to deal with as they wished. The main reason for this was the undefined yet unlimited authorization that was granted to them by the space agency statute of 2008. As this orientation propagated to the middle- and low-ranking managers, it horribly and deeply corrupted the agency. The presidents lacked the shrewdness and wisdom to manage the agency to the benefit and wellbeing of the country and the nation.

The agency was very much influenced by the environment predominating in the country itself. To implement their policies, these presidents of the agency were using two types of tools: one, the fixed employees and two, the people that were joining in numerous dummy managerial and non-managerial positions. In addition, they have attempted to use the lever of religion to advance their plans. Indeed, the three most recent presidents of the agency have enthusiastically endorsed the argument that space technologies should be developed to enable Imam Mehdi to spread his governance around the globe. It does not matter whether the Imam Mehdi would need satellites and atomic bombs for developing his leadership all around the globe, the common belief is that this vision that combines space and nuclear technologies is not humanitarian; it is sheer religious fascism. Everybody knows that space technology applications are of dual use. It is up to us to select, and either pave the way for or place limitations on each of these uses and orientations. It is obviously wise to use space technologies to benefit humanity at both national and global levels. Yet despite the positive commitments in Iran for the development of space technology applications over the period of half a century, all presidents of the agency excluding the first have chosen the course of fanaticism and mendacity.

An examination of the curriculum vitae (CV) and professional records and backgrounds of the ISA presidents, as stated publicly or officially, reveals that their records of success and achievements are undated, unrealistic, irrelevant, and sometimes simply too grotesque

to be true. The records and documents for very talented people are not as elaborate as those of the last four presidents and top authorities of ISA. Based on the documents posted on the official website of UN-OOSA, which acts as the secretariat of UN-COPUOS, the amazing qualifications and background of the second president raise the question of how the Ministry of Foreign Affairs as well as its UN-Vienna Mission accepted and supported it for submission to OOSA and distribution to COPUOS.[382] Some points in the CV are completely different from those announced officially in the English section of the website of the Iranian Space Agency and released on June 22, 2008: The deputy minister of Information and Communication Technology and the president of the Iranian Space Agency is elected as the chairman of the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space (COPUOS).[383] The ISA president is responsible for the content of his CV. When OOSA distributes the document to COPUOS members, this does mean that the information is certified by OOSA. But who is responsible when the information contradicts what is officially announced elsewhere? In the abovementioned document, the ISA president is said to have an undated master's degree in aerospace, while in the official news it is industrial engineering and/or electrical engineering. According to official records, ISA was established in February 2004 and its first president, Hassan Shafti, served until October 2005; this is what, at least formally, was reported to COPUOS by the Iranian Delegation to COPUOS. According to the official list of participants of COPUOS that is easily available through the website of OOSA, the elected chairperson of the Legal Subcommittee of COPUOS for 2010-2011 has been merely a member of the Iranian Delegation to COPUOS since 2007. The publications of the nominee and their titles reveals an explicit irrelevance between them and his educational background, while there is an absolute lack of relevance between what is in the CV and the qualifications required for the position for which he was nominated. The subcommittees of COPUOS are experts in the legal, scientific and technical issues relating to space. Consequently, the chairpersons of the subcommittees are required to be very experienced experts/scientists in the space legal, and scientific and technical issues. It is therefore amazing that for the first time in the half-century history of COPUOS, the chair of the Legal Subcommittee was a non-expert on legal issues and was inexperienced with the subject. Such a nomination certainly influenced the quality of the work of the Legal Subcommittee and didn't satisfy the expectations of the member states, as was spelled out in the official transactions.[384] OOSA wisely did not allow such politically orientated efforts to influence the high quality of the work of the subcommittee. Surprisingly, this occurred even though there were competent Iranians eligible to take international positions and capacities such as the chairmanship of the Legal Subcommittee.

On June 11, 2008, in the last days of the agency's second presidency, the author was threatened by that eminence, Ahmad Talebzadeh, for writing an article entitled 'Iran's Ambitions in Space' that was published in the Australian magazine *Position*, whose theme is the use of geo-data in a wide range of industries.[385] Via his secretary, Fatemeh Alimardani, he announced that he would cause me difficulty. It may seem surprising that a person with the stature of the president of the agency should threaten his staff directly, but his animosity derived from the fact that I was capable of working and publishing at the international level and was willing to tell the truth. In retaliation, it was made impossible for me to attend the 51st meeting of COPUOS in Vienna in June 2008 despite the urgent request of the Ministry of Foreign Affairs that I be allowed to participate.

In the first three months of Reza Taghipour presidency of ISA, its former authorities exploited his ignorance and lack of information on the status of the agency's operations. It is a common belief that if he had been properly briefed he would have done what was necessary; but he was inadequately and untruthfully briefed.

The agency has suffered a closed and suffocating condition during the tenures of its recent four presidents, an environment imposed by the security and non-civilian individuals who were the sole authorities at the headquarters in downtown Tehran. As soon as the second president of the agency took over, a six-story building which originally belonged to the Ministry of Communications and Information Technology and served as a residence for high ranking managers of that Ministry was selected as ISA headquarters in one of the crowded places in the city. There were better options, but that building was selected by the president and his deputies. The structure of the building is not very appropriate for official activities. It is comprised of four large apartments at each level, completely isolated from each other, and it is not a friendly and peaceful place in which to work. The deputies of the second president, Muhammad Izadi and Muhammad Hassan Entezari, with links to the religious and non-civilian classes, were commissioned to the space agency from MCIT as the directors of the ill-fated Zohreh and Mesbah satellite projects respectively. Like their directorships of the satellite projects, they had a portentous effect on the activities of the agency in general, and selecting the site of its headquarters in particular. The failure of their satellite projects to advance, disregarding the international hardships, is said to be mainly the result of their management incompetence.

The neo-non-civilians originated from an inert and hierarchical system. Once they gained access to the agency, it was suddenly filled with non-civilian officers in plain clothes. Their main attribute was that they had been taught to obey the orders of their superiors without question and to issue orders to their inferiors, regardless of whether the orders were wise or not. They were lacking the capability to verify, investigate and understand the issues individually, and they needed some superior to think instead of them and order them. When the plain clothed non-civilians and security officers took over the agency, its second president benefited very considerably from this mentality and character of the non-civilians. He had become acquainted with such things prior to his presidency of the agency, therefore he closely cooperated with the non-civilians. As he would frequently point out in his conversations and talks, 'It is sufficient that you try to be the first one to talk about some topic with them [the subsequent neo-non-civilian presidents of the agency], and they will accept your words and view only.' It was with such a vision that Talebzadeh in the early days of the takeover of the non-civilians at the agency approached them and committed to the practice of exaggerating and giving undeserved credit to the members of staff who he liked, so that they supposed he was a saint and one of the dignitaries of the country for space-related issues, and on the other hand blackmailing, lying about and libeling those that he was unhappy with. Although his mendacity and falsehoods were later exposed and the authorities realized he was accusing people unjustly, falsely, and intentionally, this was of no consequence as one of the basic principles of the ruling system was mendacity. Indeed, as is common in such situations, he was rewarded with appreciation. The admission of the non-civilians to the agency was a great gift to the second president of the agency, enabling him to do profound harm.

A couple of months after his official appointment, on Tuesday, November 23, 2010, the incoming president of the agency, Hamid Fazeli, visited the Mahdasht Satellite Receiving Station. During this visit, the president and his two deputies came to the author's office for a short time. This was the first time that I met his eminence. The behavior of one of the deputies was astonishing and too flattering. He was known in the agency by the pseudonym of Mohsen Rezaie and was deputy president for the applications of technology, but this was a dummy position. He was a member of the Guardian Corps of the Islamic Revolution and a security officer involved with communications issues in both the IR Iran Broadcasting Organization and the Ministry of Communications and Information Technology. The reason why his behavior so surprised me was his background. Rezaie was the first non-civilian and security officer who was openly nominated by Talebzadeh when he became second president of the agency. During the course of his own presidency, Hassan Shafti had firmly resisted employing Mohsen Rezaie, Mehdi Tabeshian, Muhammad Izadi, and Muhammad Hassan Entezari because of their obvious incompetence, despite the pressure imposed by the authorities to appoint them to top positions in the agency. As mentioned above, Izadi and Entezari were assigned the ill-fated Zohreh and Mesbah satellite projects respectively. When Talebzadeh took over, he took all these men into high positions. Rezaie was an impolite and cranky person, lacking in principles and ethics. He was indeed the executive pressure tool and an effective one, and Talebzadeh very much exploited him in destroying the values and reputation that the agency had gained during Hassan Shafti's presidency. Talebzadeh welcomed Rezaie's hooliganism. Rezaie for instance warned the author that he would block any international cooperation that the agency was pursuing or planning, and would prevent my participation in COPOUS and other international events. At that time I was still the COPUOS Bureau and G-15 member; the latter being a group comprising of the past, current and nominated COPUOS Bureau members. Rezaie often threatened to fire me from the agency. Both Rezaie and Talebzadeh were rewarded by the authorities for the situation that they introduced at the agency: Talebzadeh was made director general for International and Legal Issues at APSCO and Rezaie was nominated to the position of Deputy of the Atomic Energy Organization of Iran for international affairs while his main career was communications. Surprised by the deputy's flattery, I then listened as the president expressed his respect for me. He insisted on his appreciation of the agency's scientists and was honored by my work on the important topics of space technology. After reiterating several times, he assured me that he would support me and my work. He pointed out that he was different from the former presidents of the agency. After this very respectful treatment by the president, I wondered how he would fulfill his promises. I was not optimistic. As the fifth president of the agency, Fazeli would have to overcome the firm opposition of the deputies and entourage appointed by his predecessors and the organizational arrangements and relations that were their legacy. In order to uphold his promises, the president would need a basic staff housecleaning at the managerial level in the agency and an adjustment of its visions to conform with the realities. Of course, that never happened.

One of the important reasons why the security and intelligence as well as neo-non-civilian authorities have been interested in space technologies is its use in monitoring and controlling the urban areas. In the turmoil that followed the presidential elections of 2009 in Iran, the intelligence authorities, acting in support of the non-civilians, contemplated using aerial and space monitoring systems to monitor and control Iranian citizens with the eventual aim of suppressing the socio-political objections early. Numerous

countries use aerospace monitoring systems to acquire data and information on citizens of other countries and spy on them, but the Iranian government desires to use these technologies to spy on *its own* citizens. In line with this idea, they have been seeking to persuade the involvement of the space agency. Owing to the difficulty in accessing high-resolution satellite imagery, they have been attempting to purchase high-resolution monitoring systems and cameras mountable on high altitude balloons.

On Tuesday, March 7, 2011, in the final days of winter, the author was once again summoned by an agent of the Ministry of Intelligence. These meetings are always held in different places according to the occasion, sometimes in a hotel room, in a car when it is driven, in the lobby of an organization, or some other exceptional place. I attended as instructed and was inspected by two officers that I had never seen before. Their main question concerned AERO2011, the conference on aerospace in Iran. The inspectors pointed out the participation of the president of the agency in this conference and they were concerned whether my works and name were a matter of discussion in the conference. I replied that they would have to ask the organizers and participants. It seems that non-civilian intelligence officers are suspicious about everything.

10-3 INSOLENCE AND DISGRACE

On Saturday, February 21, 2009, the author was telephoned by one of the officers of the Ministry of Intelligence and National Security whose pseudonym is said to be Alavi. He questioned me about my planned meeting with Henk H. F. Smid, a space consultant from the Netherlands. Smid and his wife were to travel to Iran in 2009 to attend the 8th Iranian Aerospace Conference (AERO2009) that was to be held in Isfahan. I knew Smid from COPUOS meetings and especially from the time I was selected as a COPUOS Bureau member in 2003. Because Smid was to write the Iran and Brazil chapters of the book *Emerging Space Powers: the New Space Programs of Asia, the Middle East, and South America* that was to be published in 2010, he was eager to meet me, as well as the current ISA president, Reza Taghipour. I supposed at that time that no one else was aware of Smid's intentions and was surprised by the Ministry of Intelligence's interest, which I presumed to be due to informers. I later learned that it was the president of the agency who recommended that the Ministry of Intelligence investigate the visit by Smid and his wife to Iran and the planned meeting with the author. Several days later, Smid and his wife had a brief meeting with me in Tehran prior to leaving Iran. We talked about our work and cooperation. On Wednesday, March 18, 2009, I was again telephoned by Alavi, wanting to know about the meeting with Smid and his wife. Alavi said that if I wished, he would talk to the Minister to enable me to travel to Vienna to attend COPUOS and its subcommittee meetings. I was amazed. Alavi left it to me to decide whether I wished to be authorized to go to Vienna in the future as a member of the Iranian delegation to the meetings of UN-COPUOS and its subcommittees. Alavi talked to me in such a way as to convey the impression that his authority exceeded that of the president of the Iranian Space Agency. I was convinced that Alavi was sure enough that his enticement was useless and futile, and told him that the important thing from my point of view was the role that Iran ought to play in the global arena of space cooperation, and that if I was authorized to continue as a member of the Iranian delegation to international meetings, I would, as previously, do

everything I could to enhance the real national benefit and respect of the country. Smid and his wife traveled to Iran again early in February 2010 to attend the 9th Iranian Aerospace Conference (AERO2010) held at the Science and Research Branch of the Islamic Azad University. Although Smid had been officially invited by the conference organizers, the security authorities prevented his attendance because the authorities did not desire him to talk to the people there, lest he discover the true nature of the nation's space activities, which the authorities desired to keep clandestine from everyone, be they Iranian or a foreigner.

One of the unprecedented phenomena of the recent octennial period is the insolence and disgrace openly delivered by the top authorities of the space agency, very often fancifully without any basis in truth. There are many testimonials for this, including those witnessed and experienced by the author. For instance, on Monday, July 4, 2011, I was called to the office of the ISA president at the agency's headquarters in Tehran to clarify a number of misunderstandings. After welcoming my collaboration in international issues, Hamid Fazeli sought explanations about two things. His first query was, 'Why did the author of the chapters on Iran in the book *Emerging Space Powers*, Henk H. F. Smid, refer so much to your works?' The second thing was his concern about the unfavorable situation that Ahmad Talebzadeh, the second president of the agency, was facing, particularly the international criticism of his mismanagement. Surprised and irritated, I said that neither matter was practically relevant to me, and I couldn't be held responsible for the frequency of references to my works by various researchers and authors, domestically and globally. In the case of Talebzadeh, he was the only responsible person because of his disqualification, mismanagement, and abuse of his authority and arbitrations. Realizing that the president suspected that I was the origin of the criticism on Talebzadeh, I said that to accuse a specific person of organizing such criticism on Talebzadeh was unrealistic, baseless and unbelievable since it was impossible for a person to mobilize and organize the protest against Talebzadeh globally. In reality, Talebzadeh had been condemned by his own actions. The president came to realize that the suspicions levied on me were unjust and had been induced maliciously by members of his entourage. At the close of the meeting, I urged that the president seriously pursue the case of Talebzadeh in an official and legal manner, but he has left the issue idle.

Although it is mandatory that we act for the benefit of our organization and country, the author is doubtful whether this is possible if the authorities move in the opposite direction. There are a handful of examples in this connection that cause regret and disappointment. For instance, when a specialized training course was arranged by APSCO, the space agency nominated an irrelevant person to attend it. He was a security officer with duties entirely unrelated to the agency's technical officers. Although an elegist (the author of mournful poems) he was unable to read and write his native language, let alone understand technical topics and arguments in space science and technology. The agency paid for his official mission lasting about two weeks even though foreign travel was difficult to finance owing to international sanctions. By attending the course, he stole the opportunity from a relevant person for whom the experience would have been more beneficial. The authorities at ISA headquarters and the agency's representative at the APSCO secretariat were both aware of this situation. Such actions put sincere and honest efforts in the shadow.[386] This fellow is typical of the numerous agents sent abroad by the authorities in recent years.

10.2 Perhaps the authorities of APSCO and the organizers of the training course on Communication Satellite Technology and Applications, November 26 to December 7, 2012, in Bangkok, Thailand, ignored it but the authorities of ISA were well aware that the person in the middle of the front row was unable to understand the specialized technical and scientific material and discussions on space technology presented in the session in English. As a middle ranking security officer, he carried out a function very different from a specialist and technical officer. He was there to act as a watchdog for the two other Iranian delegation members, female and male, who sit to his right and left. The authorities regarded dispatching him to enjoy and financially benefit from traveling abroad to be a reward for the services that he had provided for them. He is typical of the numerous agents sent abroad in recent years. [APSCO]

Owing to the changes that have been made in recent years, things indeed proceed in the opposite direction in comparison to six or seven years ago, at least in the realm of international relations. For example, the ISA authorities hesitated to authorize the author to attend the IAC in October 2012 held in Italy, even though the organizers had scheduled me to present a highly technical paper. Instead, the agency sent two irrelevant people from its security office. Long gone is the time of Iran's active and productive contribution to the major international activities like COPUOS. Since 2006, the country's contribution has been limited to unrealistic show-offs, governmental propaganda, and the sending of intelligence officers abroad. This has undermined both national interests and respect. The atmosphere of the specialized space cooperation created in the first half of the decade has become a condition of suffocation with the space agency ridden with security agents and plain clothed non-civilian officers. The appointment of non-specialists on space-related issues as the head and members of the office for international affairs has cast Iran to the margins of the international arena and degraded that work to such an extent that it can now be carried out by the Ministry of Foreign Affairs.

During the tenure of Ahmad Talebzadeh as the second ISA president, the rapid changes made the situation unstable, prompting his dissatisfaction. He responded by libeling, asserting falsehoods, and fabricating cases against agency staff whom he did not like. He was assisted by Muhammad Mehdi Salehfard, his deputy for administrative and financial

10.3 The members of an Iranian delegation attending an expert space-related meeting in China pose with their hosts. They are examples of the non-expert officers and almost disqualified individuals which the authorities have predominantly sent to international events in recent years. [APSCO]

issues, and Muhammad Jaafar Muhammadi of his security office, both of whom are still implementing their malicious and destructive efforts at the agency.

Although his pragmatic personality sounded to be different from those of the incoming authorities of the country after the June 2005 presidential elections in Iran, Talebzadeh participated in replacing the statute for the agency approved in 2005 with the new statute that was approved in 2008. He tried to develop cooperation between the space agency and the academic sector, but this obviously remained restricted to business matters; not scientific and technical exchange and transfer, a function in which the agency was only playing a financial sponsorship role. The reason for this status was the lack of sufficiently practical and competent scientific and technical potential at both the agency and in the academic sector as a result of the political pressure to move toward business issues. Almost all of the universities were being emptied of the noble and broad-minded professors, tutors and scholars. What remains now is a new group of people who place their personal interests above the righteous aims of the country and society. The outcome is a disconcerting and regrettable piffle in which the chancellor of the Sharif Technical University, one of the top universities in the country, announced in the course of the ceremonies for the World Space Week in 2012 that his greatest desire was to hold a collective prayer ceremony on one of the planets.[387] Although this was simply a moment of thoughtlessness, it was never criticized by scholars. The fact that the bearer of this notion continues to be accepted as a member of the academic sector apparently portrays the status of this academic sector in the country.

Talebzadeh tried to follow up on the initiative of the first president of the agency by establishing a research institute affiliated to the space agency. This finally started its activity in October 2007 as the Space Research Institute (SRI). Even though the qualifications and scientific, academic and research backgrounds of a number of the experts and

scientists working at the agency (including the author) played a key role in convincing the authorities to sanction the creation of the Institute, none of them were allowed to join and work there after its inception. Hence it became an engineering corporation instead of a research institute. Disregarding its mandated aims, the SRI has employed a large number of staff based on their origins and liaisons rather than their knowledge, scientific merits and research competence. In the space agency, Talebzadeh widely pursued the strategy of 'bone for horse and hay for dog' and this has been supported by his successors.

The unwise actions of the non-civilians finally prompted the dismissal of the second president of the space agency. However, owing to his brilliant services and efforts in changing the statute of the agency, the authorities in the non-civilian sector nominated and provided him with the opportunity to work with APSCO as director general of the Department of External Relations and Legal Affairs. He started his work there in January 2010, following the inception and official establishment of APSCO. In addition, based on the nomination made by the Iranian authorities, he was chairperson of the Legal Subcommittee of COPUOS for 2010-2011, although in this capacity he was unpromising and garnered resentment according to the world media.[388–391]

When APSCO started its work in 2010 the policy for selecting its staff was to have one from each of the founding countries, and Talebzadeh was nominated by Iran. However, this was very surprising because he lacked the background and qualifications for international and legal issues. But there had been no selection process, he was simply nominated. Given that APSCO was established with funds and investment of its members, its secretariat is responsible for ensuring that its member nations send competent people. That was made clear by the announcement for the International Staff Recruitment of APSCO that was distributed officially to all member countries. Its first paragraph reads as follows: 'According to the international staff posts approved by the First Meeting of the Council of APSCO, eight international staff in total are to be recruited. It is required to recruit the best candidates qualified for the posts from the Member States on the basis of openness, transparency and impartiality …' As an international center of excellence, APSCO deserves high quality people, including in administrative posts. It is not a political organization and it should be free of any political people. The presence of Talebzadeh on its staff is the hallmark that APSCO's authorities do not care for quality and/or merit.

As noted, Talebzadeh was also selected to chair the Legal Subcommittee of COPUOS in 2010-2011 even though it was apparent in Iran that he lacked any background and knowledge about legal issues in general and about space law in particular. He was indeed the first chairperson of the Legal Subcommittee of COPUOS in its half-century history that was a non-expert in space law. His poor quality, as revealed in its meetings, was a matter of great regret for the country.

The disgraceful nomination of the dismissed second president of the Iranian Space Agency to join the APSCO staff and to chair the Legal Subcommittee of COPUOS was simply a political attempt by the Iranian government to place a non-expert in highly specialized international positions.

Talebzadeh's incompetent management as the second president of the agency, his discrimination against and persecution of personnel and expert staff of the agency, his administrational breaches, his unjust and obstinate actions at the agency, and the complaints that this turmoil generated, convinced the non-civilian authorities to take direct control of Iran's only civilian national spacefaring entity.[392]

The Mahdasht Satellite Receiving Station was remarkable for satellite data acquisition all around the globe in the 1970s. The commercialization of remote sensing technology was abandoned for years after the revolution of 1978 and from the viewpoint of the staff and personnel of the Iranian Remote Sensing Center and later the Iranian Space Agency, Mahdasht was used mainly as a place of exile for members of staff who had displeased the top authorities of the agency. Since the abandoned receiving station resembled a remote and isolated island, the authorities readily banished there everyone who they desired not to see in their surroundings. The irony was that it was the IRSC in conjunction with some other institutions that organized the establishment of the space agency early in 2004. What had been the national entity in charge of space-related issues throughout the country was now a place for institutional exiles.

10-4 SEASON OF IMPOSTURE

As witnessed by the author, after Reza Taghipour took over as ISA's president in July 2008 he directed in his introductory remarks delivered on August 5 that the personnel of the agency must work hard to develop satellites because the Imam Zaman (Imam Mehdi) needed satellites and atomic bombs to expand his governance around the globe. According to the instructions of Shiism, which is the ideology of the current rulers of Iran, Imam Zaman is the leader of the Shiite Islamic sect. Although he has been absent for 1,400 years his followers await the return of their Imam to rule and spread justice. In their view Imam Mehdi will not return until the world is awash with corruption, injustice, horror, fear, terror, and ravage, with honest people suffering under oppression. Naturally his acolytes feel obliged to provide these conditions. Holding this view, the third ISA president also insisted that the goal of delegates of the agency attending international events should be to repulse evil, an idea counter to the high and valuable ideas behind the philosophy and policy that established ISA.

The space agency is now under the explicit governance of the neo-non-civilian and security intelligence people. One dare say that this entity, originally intended to be a center of excellence for promoting the advancement of space science and high-tech in the country is nothing but a political security institute for which space science and technology is not the priority. The staff and personnel that are part of the abovementioned groups, or others who are in accord with their expectations, are the leading players at the agency nowadays. Those holding what are considered dissident views, are marginalized, exiled or expelled.

In the years since the new statute of 2008 provided unspecified and yet unlimited authority to the president of the agency, the author has witnessed a locust-like influx of arrogant self-styled managers and officials that are recommended by other top authorities of the country. They have no appreciation of space and space technology; the agency is seen as a means of livelihood, a process for personal gain and an opportunity to indulge in corruption. Although their behavior is contrary to the mandate of the agency as a civilian entity, it is in harmony with the plan for the involvement of the non-civilian sector in the economy, politics, and all aspects of the national administration, one part of which is the Iranian space endeavor.

11

Concluding discussion and future outline

Iran's contribution to space started in 1958, when it joined the United Nations plan for international cooperation in space. In the early 1970s the United States assisted Iran in establishing a satellite data receiving station. Until the advent of the revolution in Iran in 1978, which led to victory a year later, Iran was an active contributor to the space-related international effort, chiefly in cooperation with the United Nations. The next serious national effort to develop and use space technologies for peaceful purposes did not start until the early 1990s, after a decade of revolutionary upheavals and a war with Iraq. The design and development of the Zohreh, SMMS, and Mesbah satellites are examples of the post-war national effort to acquire space technologies. Iran relies upon its own human resources and technological capabilities to attain its scientific goals for improving the national wellbeing. Iranian technical capabilities in space sciences and exploration are increasing rapidly. Investing in space is very expensive and can be justified only if all the achievements of the space program are integrated into the social, economic, educational and technical life of the nation. The creation of an indigenous capability has provided Iran with unprecedented pride. Iran's advances could potentially provide an impetus for productive cooperation in space with other nations. International cooperation of a kind similar to the framework of COPUOS activities on the peaceful uses of outer space, could serve to improve the world's understanding of Iran's space policy and its vision.

As noted in the early chapters of this book, all domains of the space endeavor, including life in space, space exploration, protecting the environment, improving the quality of daily life, and even national security, require the involvement of bilateral, regional, and international cooperation. The important point is that such cooperation be undertaken in a way that respects the humanitarian rights of each nation, delivers benefits to each nation, and is without efforts by individual nations to achieve supremacy. The highest priority is to benefit humankind by establishing a secure globe that promotes the safety and prosperity of all peoples, free of race, color, culture, or other humanitarian requisites.

Iran's space endeavor is affected by the interaction of visions in the space science and technology arenas. There is still no scientific and technical empirical activity focused on space. The efforts are devoted to developing the technologies required for traveling to space. Disciplines like aerospace and mechanics are expected to be the engine instruments for exploiting space. From a scientific point of view (although not from an engineering

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point of view) aerospace and mechanics are simply branches of physics. Space science must be conducted from a physical point of view and vision, and developed theoretically and practically in space and aerospace physics laboratories. Few visions about space and space technology applications are distinguishable in Iran. One vision comes from aerospace people. In Iran, the academic background for aerospace dates back only around 15 years, when some of the leading universities began to offer courses in the subject. The followers of this vision believe that space and space technology are confined to traveling to space. Iran has a long history of air transportation, and aerial technologies have had the opportunity to mature. This concept drives the vision of the aerospace people. It is also the vision of the traditional academic sector. Another vision is that of the communications people. Space technology issues have long been conducted by the Ministry of Communications and Information Technology, and before that the Ministry of Post, Telegraph and Telephone. Owing to the nature of their educational and business backgrounds, the authorities of the Ministry believe that space and space technologies are best covered by the communications concept. This vision is a type of filter that imposes a broad limitation on the development of applications and understanding of the comprehensive aspects of space. The third existing vision about space and space technologies in Iran views the topic through the lens of applications. This end-user vision clearly lacks synopsis, and depends on what the technology market offers at any given time. There is also a fourth vision about space and space technologies that is still waiting to play its role. If space is regarded from the point of view of natural and physical sciences, then traveling to space and every space application can be considered as benefiting humankind in every possible potential, according to the conditions of that time. Actually, this is the most convenient and empirical vision that is necessary to be supported and strengthened.

Investment in the aerospace industry in Iran, like in space sciences, is mostly public investment. The reason for the scarcity of private investment in the aerospace industry might possibly be lack of public awareness of the size of the outlays that this industry requires. Generally, because of national security concerns, the size and composition of aerospace investments are not publicly revealed. This lack of information has resulted in few, if any, private sector investments. This is different from the aviation industry, which has drawn considerable private capital, particularly in air tourism. It is not surprising that Iran's domestic capabilities in aerospace technology lag behind advanced industrial countries. The factors contributing to this situation are not unique to the aerospace industry, and are common to developing countries. These are inadequate capabilities in the design and manufacture of the products; inadequate process innovation, and a lack of innovation in general; poor protection of intellectual property; poor support and marketing; and weakness in the commercialization of existing products and processes. For Iran, the situation is aggravated by international sanctions that make it difficult to procure technologies, instruments, and parts from abroad. Moreover, in the absence of a coordinated policy, investment is often wasted on duplicate projects. However, based on the General Plan for Development of Aerospace Science and Technology in Iran, it is expected that a number of main objectives will be carefully considered. These include a purposeful, balanced development of those branches of aerospace science and technology that are harmonious with national advantages and capabilities; converting the aerospace industry to one of the principal means of acquiring knowledge and wealth for increased national welfare;

improving national security by development of aerospace science and technology in cooperation with other countries in the region; encouraging the private sector to play an effective role in national and international aerospace activities; increasing the global competitiveness of domestic aerospace research and technology centers; increasing labor productivity of experts in production of aerospace science and technology; and acquiring capabilities to design and manufacture aerospace products to meet national needs and to establish a productive presence at the international level.

Following the approval of the Iranian Administrational Supreme Council late in September 2010, the Iranian Space Agency (ISA), the pivotal player of the Iranian space endeavor, was annexed to the Presidential Institution, after having spent about seven years under the Ministry of Communications and Information Technology. This administrative promotion is an indication of the significance that the government places on space activities. However, this change has yet to be endorsed by the Iranian parliament. In particular, it is necessary to clarify the relationship between ISA and the Space Supreme Council (SSC), the supervisory entity which was dissolved in 2007 and revived by the approval of the Expediency Council in September 2008, and to redefine the functions and duties of ISA in this new position based on the aims and the mandates of the SSC. Even though the legal status of its annexation is ambiguous, efforts have begun at ISA to portray a new configuration for the agency that is expected to crystallize a new organizational chart for approval. This reportedly gives the highest significance to technology development and research on engineering of space systems, including satellites, manned space flights, space probes, space-related sciences, and ground launching platforms. Expensive space technology development that does not address the social needs for rapid national development would likely fail to gain the enthusiastic support of the public.

The necessity for an appropriate law on space activities is clear. This must provide the legal and administrative infrastructure in the Iranian space endeavor. The management and administration of space was recognized to be a sophisticated issue and procedure. Although almost everybody in Iran agrees that competence and meritocracy are essential criteria, identifying what is meritorious is not a simple process. From the viewpoint of the authorities, the criteria in practice influence seriously the legislative process and the implementation of laws. In recent decades in Iran, relationships based on the privileges granted to particular social classes has resulted in top managerial and administrative positions being reserved for people from those classes. The institutional background of the Iranian space endeavor can be divided into four main periods, each of which starts with an important event that can be considered as a turning point. The first period began with the approval and establishment of the agency. The next period started with the change of government by the presidential elections of 2005, which led to immediate modification of the managerial orientation of the agency. Approval of the new statute for the agency initiated the third period. And finally the fourth period started with the annexation of the agency to the Presidential Institution, the legal status of which remains ambiguous. It is obvious now that even if the efforts to set up a well-defined and comprehensive legal regime for the Iranian space endeavor can be successfully implemented, this will not address the problem of the unjust criteria used when selecting the management and administrative positions. The administration of the agency is still based on the statute of 2008, even though it no longer works under the Ministry of Communications and Information Technology.

The revival of the Supreme Space Council has not been recognized by parliament, therefore its role in supervising the nation's space endeavor since the approval of the 2008 statute of the space agency is ambiguous; as indeed is the agency's divergence from the council's views and decisions. The benefits of this ambiguity and suspension status are so enticing for some people in and out of the agency that they are reluctant to improve the situation.

Since the successful launch of its first home-made satellite, Omid, on February 2, 2009, Iran has started a new effort for designing, manufacturing and launching satellites into orbit. Although Omid was an experimental satellite with the short-term mission of performing orbital measurements, the experience and knowledge gained through orbiting and operating it opened the door to set up more sophisticated systems to carry Earth observation apparatus and communications and research tools. Practical experiments on life in space started with the development of a bio-capsule in line with the central plan to send an Iranian citizen into space by 2021. In 2010, Iran developed a more powerful launch vehicle named Simorgh to carry heavier satellites into orbit. In addition, the nation has been witnessing a boom in designing and developing satellites. The research microsatellite called Navid was developed by the Iran University of Science and Technology and orbited on February 3, 2012 with an Earth observation mission. The Rasad satellite launched on June 15, 2011 was developed by the Malek Ashtar Technical University affiliated with the Ministry of Defense and Armed Forces Logistics, in collaboration with the Ministry of Communications and Information Technology. New satellites like AUTSat, Tolou, Mesbah-2, Fajr and others are on the way. There has been a three-fold growth in the number of Iranian satellites developed after the launch of Omid, in comparison to those planned before it. In recent years, significant state funds have been used to persuade the academic and non-civilian sectors to jointly or independently design satellites and launchers/rockets. Such a surge of activity requires central policy-making, coordination of functions, and financial supervision under the auspices of the SSC. This is especially urgent because there has been an effort by the designers in the academic and non-civilian sectors to draw on the financial sources without having an advanced plan. It is necessary to be open-minded and attract the efficient contribution of all competent talents in management and science and technology development. In the meantime, a key issue is the sharing of information, knowledge, and expertise between the working groups of the universities participating in satellite development. All legislation, administration, management, and executive efforts play a vital role in this connection because, individually or synergistically, each is influenced by the attitudes and vision of the authorities and policy-makers. The success of the Iranian space endeavor will depend on whether the visions and attitudes are realistic, open minded, and free of bigotry.

Iran pursued the development of several satellites by international cooperation but these suffered from a steep decline in the country's international standing that prompted partners to withdraw from projects, and mismanagement when Iran attempted to continue alone. The situation for the domestic satellites is different, with development being determined by the corruption and unrealistic vision of the authorities. It is unlikely that the managers and top authorities of the Iranian space endeavor have remained immune from the corruption that exists in the highest managerial levels of the country. The truth of this is the unrestrained and unjust embezzlements, plus wasting of financial or non-financial sources through entrusting the issues to disqualified and incompetent individuals in all the

different sections of space activities, even though people with competent expertise are available. The rational way, possibly would be to proceed on logical and open-eyed international interaction and to coordinate in the meantime existing internal potentials in a vigilant and sagacious manner consistent with international conditions and status, to optimally benefit from the ongoing condition.

Because the annexation of ISA to the Presidential Institution still awaits legislative approval, the research institutes that joined forces with ISA require this approval in order to legitimately conduct and implement their functions under the space agency. Although the agency's research ambitions are feasible, there are fundamental and deep gaps between the actual capabilities of its research institutes and the requirements needed to pursue such research. This is because the institutes were established under ministries with different aims, policies, and managerial orientations. Their decision-makers and planners are used to undertaking research from an engineering point of view that is inappropriate for their new role. Indeed, research is not yet institutionalized in the Space Research Institute (SRI) and the Engineering Research Institute (ERI), which was initially the Agricultural Engineering Research Institute (AERI). The situation is somewhat more favorable at the Aerospace Research Institute (ARI). The configurations and structures of the institutes must be modified to comply with the research needs of ISA and the country in space science and technology, particularly from the viewpoint of applications development, a field that is currently being deliberately and unjustly ignored. In particular, it will be necessary to modify the recruitment methods of the institutes in order to employ the most qualified people. Only then will the institutes be able to conduct meritorious research into the applications and services of space science and technology that will benefit the quality of life of the Iranian population.

Although a major part of the space agency is devoted to so-called research, this is merely a façade. It is not research carried out to comply with real demands and vital needs and goals. Its main purpose is to make benefits and privileges for the participants, particularly opportunities for financial benefit. The large number of so-called research plans act as the sandbags that weigh down the balloon of the space agency, preventing its ascent and rendering futile the nation's space endeavor. In recent times, titles like Azragh, Nasr, Masoud, and so on, have been very often on the tongues of the authorities in relation to space and space technologies, almost all with ambiguous aims and means, and all lacking genuine materialization. This dispersion and multiplicity requires shrewd management and guidance.

One might wonder why the non-civilian sector, in spite of the fact that it has had access to a great source of finance in recent years and facilities and potentials all around the country, has attempted to instrumentally use the Iranian Space Agency. The answer is almost certainly that even with access to all these resources the non-civilian sector lacked the reputation of the space agency, especially in the international arena. Actually, they misused ISA's reputation to advance their intention of hegemony and cover their activities of harassment. On the other hand it is fair to say that the aerospace activities of Iran have always benefited from contributions and assistance by the non-civilian sector. The non-civilian sector's role and influence in the Iranian aeronautics endeavor is undeniable. Why is it not as promising for aerospace as it has been for aeronautics? This can be attributed to how the status and vision of the non-civilian sector have changed over the years. Prior to

the socio-political uprising of 1979 in Iran, the non-civilian sector consisted of brave, devoted and patriotic individuals seeking to respect and advance the glory, honor and reputation of their country and nations all around the globe. However, after the revolution in Iran the non-civilian sector was divided into two parts: those that belonged to the pre-revolution martial forces, and those that formed the military forces established to protect the government. The pre-revolution martial forces were abandoned by the new government and the new non-civilian entities received the highest support and credit. Since the core idea and vision of these neo-non-civilians were a type of religious order, the above-mentioned honorable characteristics were put in the shadow and failed to receive deserving consideration and respect. The majority of the neo-non-civilians have always been regressive individuals, lacking education and competence despite their bearing officially high academic certificates. It is therefore clear why the motivations of the non-civilian sector in the aerospace endeavor in recent decades have been so different from their honorable predecessors. These neo-non-civilians ought to be restrained from entering the domains that do not belong to them.

A monopoly in management and turmoil in legislation have hamstrung the advancement and prosperity of the Iranian space endeavor. Even if the country succeeds in resolving the legislative problems, the complexities of management and administration will persist and hinder the pace. The authority awarded to the ISA president by the statute of 2008 paved the way for a new order in the agency because it gave him total freedom in allocating funds and recruiting human resources. As a result, and particularly since its annexing to the Presidential Institution, the agency has become an alluring showcase for space activities which are principally carried out by the non-civilian sector in cooperation and coalition with the academic sector, the latter having been transformed to eliminate true experts. The only role left to the agency is to financially sponsor the space activities of entities all around the country and report on those activities publicly. By doing so, the non-civilian entities were readily able to venture abroad under the mask of an agency which had been founded for the peaceful use of the applications of space technology.

The main activity of a certain clique of intimates at the agency in recent years has been plundering its finances and assets. Although corruption swells throughout the agency, there is still talk about the application of the highest technologies to space. This sounds too good to be genuine. One should not expect that such work could be carried out at the research institutes affiliated with the agency. These operate in the role of a broker and contractor, supplying the funds for all-too-often dummy plans and projects. If it is accepted that the governmental, political, economic, and social corruption in Iran is a fundamental component of the narrative of life in the country, there is no reason to expect the space agency to be immune. Although space science and technology can be an effective tool for improving the quality of life at national, regional and global levels, the Iranian space endeavor is unlikely to lead to success and prosperity because its managers, technocrats, and experts have unrealistic visions and means of thinking and acting. Basic revision is mandatory in separating the trajectories of the civilian and non-civilian activities in Iran. Demilitarization of the civil space activities in Iran would open the way for the space endeavor to reassert its past reputation for positive involvement.

The authorities of the space agency took everything as a means for trial and error, although they knew the results in advance. Their decisions have imposed large

expenditures and they have failed to learn the lessons of their errors. Unfortunately, it is a common belief that the benefits and interests of stretching and prolonging or willingly delaying the implementation of a project are more alluring than when the work is completed on time. As a result, the Iranian space endeavor has difficulty achieving the desired benefit of its work. Instead of offering equal opportunities to its employees, the agency is making privileges available exclusively to its insiders and intimates. This situation applies in all parts, sections, and subsidiary entities of the agency. In the last decade, the idea of service to the agency and the country has been superseded by the notion that the agency and all of its assets belong to its senior management to do with as they wish. Instead of distributing duties justly, is it common to offer multi-positions to insiders and their trusted entourage. The situation is now so bad that the genuine and real experts and staff are denuded of all privileges.

The amazing thing about the Iranian space endeavor is that from the managerial viewpoint in the recent septennial, there is practically no distinction between ambitions and delirium because they are intermixed. Space technologies are seen by the authorities as the best means of attaining the desired hegemony and control. But from the viewpoint of the Iranian technocracy, these ambitions stimulate national pride and respect; things that Iranian society in general and its technocracy in particular have been attempting to retrieve for decades and perhaps centuries. Nevertheless, the shortsightedness and paranoia of the authorities are annoying and disappointing to the technocracy. This frustration is like fire beneath ashes, in that it will flare up when exposed. The young generation of technocrats in Iran will certainly have the final word. They will hopefully remove the obstacles that hamstring the space endeavor.

The narrative of Anousheh Ansari's journey into space and the manner in which it happened has many things to teach us. It is an indication of tremendously exciting, wonderful and important facts that are undeniable. That an Iranian was able to reach space despite many difficulties and obstacles, indicates how the system retards the enthusiasm and high hopes of Iranian individuals. What Ansari achieved and the way that she did it is the dream of countless Iranian children, teenagers and young people. She has stated that she pursued her dream of reaching for the stars on behalf of all Iranian enthusiasts. Reading about the lives and fates of Iranians like Firouz Naderi, Anousheh Ansari and others reveals how they were ill-treated in their native country. The contemporary history of Iran is full of stories of how people were annoyed, insulted, and unethically threatened by the arrogant and cranky authorities. They belong to the large group of enthusiastic Iranians who were banished to the margins by the authorities, or left the country in order to fulfill their dreams. In humanitarian terms, they are all genuine assets of the Iranian space endeavor to be proud of. They ought to be invited to return. However, this would be possible only if the shortsighted and selfish fanatics are rejected and real and humanitarian values are respected and appreciated free of imposture and dissimulations.

The Iranian technocracy can be divided into two distinct groups: one that prioritizes the conscience of proficiencies, and another with instrumental spirit that offers their knowledge and capabilities freely to whoever rewards them, regardless of the aims of those they serve and how their technical work is applied. If it is acceptable that tact, insight and realism are all necessary for proper management and implementation, and that success will not otherwise be attained, then foolish and imprudent deeds aren't likely to lead to success. The

Iranian space endeavor has always been a battle between good and evil. Its path depends on the vision predominating at the agency, supported by the top authorities of Iran. When wisdom predominates, it goes the correct way and creates optimism, and when the authorities lack sufficient wisdom and a realistic vision, everything goes astray. For the Iranian space endeavor, the good and bad, and the pure and non-pure, should be separated. It is time for that separation. No doubt to manage a system, whether it is good or bad, managers need cooperation, compromise by the people running the system, and compliance. Does the future of the Iranian space endeavor depend on the continuation and persistence of the current corruption? Of course not. In order to succeed it must rid itself of this corruption and instead pursue realistic, genuine, and basic values.

Which component of the Iranian space endeavor is capable of initiating new developments for the nation or the world community? What will change if Iran sends astronauts into orbit or to the Moon? What will happen if Iran becomes the leading spacefaring country in the Middle East? It cannot be in order to occupy new land, since the authorities say Iran is a blessed land in terms of natural resources, easily able to accommodate thrice the current population; a fact that has led the authorities to cancel a plan for population control. Yet the chancellor of one of the top universities in Tehran has stated that his greatest wish is to hold a collective prayer ceremony on one of the planets. Is all of this paranoia? What is wrong and what is correct? Isn't it astonishing that in Iran's universities no one criticizes and everyone accepts this as possible! Is it the delirium of people who don't realize what they are saying? What is obvious is that if Iran uses space technology based on wisdom and open-mindedness under a well-oriented and organized plan, it will definitely improve the quality of life, the status of wellbeing, welfare and prosperity of the nation. It will be a great triumph for the Iranian nation. Russia has not sent anyone to the Moon, but it is one of the leading spacefaring nations. The same is true of China, India, Japan and others. They are all applying space technology to improve their national progress.

The ship of the Iranian Space Endeavor is capable of heading towards progress and improvement of the nation. But first the ship must be cleaned of impostors and turned in a direction that takes into account realities and supports genuine and noble values. There is plenty of time for journeying to the Moon and holding prayers on other planets, but for earning respect and improving the welfare of the nation time is scarce and every opportunity should be pursued.

The Iranian space endeavor has developed considerably in the course of recent years. This is also true of the corruption and mismanagement that has grown tremendously in almost all domains of the endeavor. This corruption is the collective sum of the corrupted components and inputs from each of the authorities of the agency, from the highest level of responsibility to the lower ranks. This reflects the deeper corruption that now pervades the state. Mismanagement has prevented the space endeavor from flourishing. It is certain that, without this impediment, the endeavor would be in a much better position. The immediate challenge facing the Iranian space endeavor has therefore how to rid itself of the corruption that has crippled it.

It should now be apparent to the reader how the attitudes and visions of the leaders of the Iranian Space Agency, and others, have influenced and contributed to the pace, progress and developmental objectives of the nation's space endeavor. If it is managed with

wisdom and shrewdness then it will prosper. If it is ridden by incompetence and poor sagacity, it will fail. The top authorities are chiefly responsible for introducing and sustaining the corruption and flaws in the system. During the recent octennial period, the pyramid of power at ISA became more corrupted the higher it went. This also applies to the current administrative and organizational configuration in Iran in general. But to be of real benefit to the nation the Iranian space endeavor needs a serious revision of its plans, visions and management. Can the agency recover? It is the author's belief that it will happen eventually. Clearly the current management structure and authorities must be changed. Will ISA's reputation be revived? The answer is that if the vision and methods employed by the current authorities continue, the dream of returning to those positive and progressive days will not be fulfilled. However, if the perversion is removed and the flaws and follies pervading the endeavor are corrected, then what remains will be a reliable means of advancing more than ever before the prosperity of the Iranian space program. The relationships should be changed in every field, particularly in research for the development of space science and all manner of applications beneficial to the nation. If that new structure is allowed to act based on wisdom, particularly in management, rejecting all the feeble-mindedness, then the status of the Iranian space endeavor will be changed to an unbelievably good condition.

Appendix

Statutes of the Iranian Space Agency

This is an unofficial translation by Parviz Tarikhi of the 'Statute of the Iranian Space Agency' (2005 and 2008) that was published in the *Journal of Space Law* in December 2008 for the convenience of its readership.[393] The original documents in the Persian language are included and are available on the Internet at *http://www.itna.ir/archives/documents/010742.php* and also at *http://parviztarikhi.wordpress.com/features-2/statutes-of-iranian-space-agency-2005-2008/*.

2005

The Cabinet of the Islamic Republic of Iran in its meeting of June 11, 2005, according to proposal number 100/14310 of the Ministry of Communications and Information Technology dated August 9, 2004 and citing Article 9 of the Law for Tasks and Authorizations of the Ministry of Communications and Information Technology that was approved on December 10, 2003 by the parliament, passed the statute of the Iranian Space Agency as follows:

STATUTE OF THE IRANIAN SPACE AGENCY

Article 1: Aiming at implementing the decisions of the Space Supreme Council of Iran for the study, research, design, engineering and execution of space services and remote sensing technologies, and strengthening the communication networks and space technology inside and out of the country, and the sovereign activities of the Iranian Remote Sensing Center and the Ministry of Communications and Information Technology, benefiting from the facilities and human resource of the Department of Design, Engineering and Installation of Satellite Communications and the Department of Maintenance of Satellite Communications both affiliated with the Telecommunications Company of Iran, the Iranian Space Agency which is briefly referred to as 'Agency' in this Statute, is established.

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Article 2: As a legal entity, the Agency is a financially independent official foundation affiliated with the Ministry of Communications and Information Technology.

Article 3: The Agency's tasks and authorizations are as follows:

I Pursue and implement the decisions of the Space Supreme Council.

II Prepare and regulate mid-term and long-term programs for the country's space sector in cooperation with related institutions for proposal to the Space Supreme Council.

III Undertake studies for policy-making in designing, manufacturing, launching and using research and applications satellites, and provide space services for proposal to the Space Supreme Council.

IV Plan to conduct and develop space technology for peaceful purposes, strengthen national, regional and international communication networks operated by the state, cooperative and private sectors, and monitor their implementation in accordance with the policies approved by the Space Supreme Council.

V Apply specific studies, research and education in the development of space science and technologies.

VI Study the requirements for conducting satellite and other space technology projects in accordance with the decisions of the Space Supreme Council.

VII Contribute to the implementation of national and regional satellite projects in accordance with the decisions of the Space Supreme Council.

VIII Authorize space activities aimed at sustaining and coordinating the exploitation of space technologies and facilities including satellites, direct receiving and transmitting stations, and satellite control in accordance with the decisions of the Space Supreme Council.

IX Cooperate with related clients in assessing the competence of non-governmental contractors and advisors for implementing space-related executive and research issues in different parts of the country.

X Represent, nominate membership and attend related regional and international societies and unions aimed at protecting national interests in accordance with the regime's main policies and other laws and regulations.

XI Implement regional and international cooperation programs in space issues in accordance with the regime's main policies.

XII Manage and exploit satellite and orbital positions in coordination with responsible bodies and pursue their international registration for optimum use of space sources.

XIII Prepare the regulations and statutes related to the tasks in Article 9 of the Law for Tasks and Authorizations of the Ministry of Communications and Information Technology approved in 2003, for proposal to legal referents for approval.

XIV Establish a national archive for centralized storage, classification and updating of space data.

Nota Bene 1: The Agency is obliged to apply the highest capacity of the non-governmental sector in the framework of the policies of the Space Supreme Council for implementing its tasks and affairs.

Nota Bene 2: Determining the security competence in Clauses VIII and IX in this Article will be the responsibility of the related clients.

Article 4: The Agency's finances will be provided from the public funds and credits in the country's annual budget.

Nota Bene 1: The facilities, records, human resources and funds allocated to ongoing national and research projects in the Ministry of Communications and Information Technology are transferred to the Agency.
Nota Bene 2: By coordination with the Management and Planning Organization of Iran and in the framework of its annual budgets, the Agency can use the assistance and other fund sources of the Ministry of Communications and Information Technology and its affiliated organizations and companies, and other institutions.

Article 5: After formulation by the Agency and confirmation by the Management and Planning Organization of Iran, the organizational chart of the Agency will take effect.

Article 6: The president of the Agency will be appointed by the Minister of Communications and Information Technology, and will hold the highest executive position at the Agency. This person will simultaneously be the Deputy Minister of Communications and Information Technology and secretary of the Space Supreme Council.

Article 7: In accordance with the full rights and authorizations in the framework of regulations, the president of the Agency will be responsible for managing the implementation of the decisions of the Space Supreme Council. The president will be responsible for protecting the rights, interests and assets of the Agency. The president can delegate authority with official notification, but will ultimately represent the Agency before all legal authorities.

According to letter number 84/30/12612 dated June 18, 2005 this Statute was passed by the Guardian Council.

Persian text of the Statute of 2005

هیئت‌وزیران در جلسه مورخ۱۳۸٤/۳/۲۲بنا به پیشنهاد شماره۱۰۰/۱٤۳۱۰مورخ ۱۳۸۳/۵/۱۹وزارت ارتباطات وفناوری اطلاعات و به استناد ماده (۹) قانون وظایف و اختیارات وزارت ارتباطات وفناوری اطلاعات – مصوب ۱۳۸۲ - اساسنامه سازمان فضایی ایران را به شرح زیر تصویب کرد:

اساسنامه سازمان فضایی ایران

ماده۱ - به منظور انجام مصوبات شورای عالی فضایی کشور و امور مطالعاتی، پژوهشی، طراحی، مهندسی و اجرا در زمینه فناوری‌های خدمات فضایی و سنجش از راه دور و تقویت شبکه های ارتباطی و فناوری فضایی در داخل و خارج از کشور و تجمیع فعالیت‌های حاکمیتی مرکز سنجش از راه دور ایران و وزارت ارتباطات و فناوری اطلاعات، **سازمان فضایی ایران** که در این اساسنامه سازمان نامیده می‌شود، با استفاده از امکانات و نیروی انسانی اداره کل طرح و مهندسی و نصب ارتباطات ماهواره‌ای و اداره کل نگهداری ارتباطات ماهواره‌ای شرکت مخابرات ایران تشکیل می‌گردد.

ماده ۲ - سازمان دارای شخصیت حقوقی و استقلال مالی است و به صورت موسسه‌دولتی وابسته به وزارت ارتباطات و فناوری اطلاعات اداره می‌شود.

ماده ۳ - وظایف و اختیارات سازمان به شرح زیر است:

الف - پیگیری و انجام مصوبات شورای عالی فضایی کشور.

ب - تهیه و تنظیم برنامه های میان مدت و بلند مدت در بخش فضایی کشور با همکاری دستگاه‌های ذیربط جهت پیشنهاد به شورای عالی فضایی.

پ - انجام مطالعات به منظور تدوین سیاست‌های طراحی،ساخت،پرتاب و استفاده از ماهواره‌های تحقیقاتی و کاربردی و ارائه خدمات فضایی جهت پیشنهاد به شورای عالی فضایی.

ت - برنامه ریزی به منظور هدایت و گسترش استفاده صلح‌آمیز از فضای ماورای جو و فناوری فضایی، تقویت شبکه‌های‌ارتباطی ملی، منطقه‌ای و بین‌المللی توسط بخش‌های دولتی، تعاونی، خصوصی و نظارت بر اجرای آن‌ها در چارچوب سیاست‌های مصوب شورایعالی فضایی.

ث - مطالعه، پژوهش و آموزشهای کاربردی خاص در زمینه توسعه علوم و فناوری‌های فضایی.

ج - بررسی نیازها و اجرای پروژه‌های ماهواره‌ای و سایر فناوری‌های فضایی در چارچوب مصوبات شورایعالی فضایی.

چ - مشارکت در اجرای پروژه‌های ماهواره‌ای منطقه‌ای و ملی در چارچوب سیاست‌های کلی نظام و سایر قوانین و مقررات.

ح - اعطای مجوز برای فعالیت‌های فضایی به منظور بهره‌برداری منسجم و هماهنگ از فناوری و امکانات فضایی شامل ماهواره‌ها، ایستگاه‌های اخذ مستقیم، ایستگاه‌های ارسال مستقیم و کنترل ماهواره‌ها در چارچوب ضوابط و مقررات.

خ - همکاری با مراجع ذیربط برای تعیین صلاحیت پیمانکاران و مشاوران غیردولتی برای انجام امور اجرایی و تحقیقاتی فضایی در بخش‌های مختلف کشور.

د - نمایندگی، عضویت و حضور در مجامع و اتحادهای منطقه‌ای و بین‌المللی ذیربط به منظور حفظ منافع ملی در چارچوب سیاست‌های کلی نظام و سایر قوانین و مقررات.

ذ - اجرای برنامه‌های همکاری منطقه‌ای و بین‌المللی درامور فضایی درچارچوب سیاست‌های کلی نظام.

ر - مدیریت و بهره‌برداری از موقعیت‌های مداری و ما هواره‌ای و هماهنگی با دستگاه‌های مسئول و پیگیری جهت ثبت بین‌المللی آنها به منظور استفاده بهینه از منابع فضایی.

ز - تهیه و تدوین مقررات و آیین‌نامه‌های مرتبط با شرح وظایف مندرج در ماده (۹) قانون وظایف و اختیارات وزارت ارتباطات و فناوری اطلاعات مصوب ۱۳۸۲ - جهت پیشنهاد به مراجع قانونی.

ژ - ایجاد بایگانی ملی و تمرکز در نگهداری و طبقه‌بندی و بهنگام سازی اطلاعات فضایی.

تبصره ۱ - سازمان موظف است برای انجام امور و وظایف محول شده از حداکثر توان بخش‌های غیردولتی در چارچوب سیاست های شورایعالی فضایی استفاده نماید.

تبصره ۲ - مسئولیت تعیین صلاحیت‌امنیتی درخصوص بندهای ح و خ این ماده با مراجع ذیربط خواهد بود.

ماده ٤- اعتبارات مورد نیاز سازمان در وجوه و اعتبارات عمومی بودجه سالانه کشور پیش‌بینی و تامین خواهد شد.
تبصره ۱- امکانات، سوابق، نیروی انسانی و اعتبارات پروژه‌های ماهواره‌ای ملی و تحقیقاتی جاری وابسته به وزارت ارتباطات و فناوری اطلاعات به این سازمان منتقل می‌گردد.
تبصره ۲- سازمان می تواند با هماهنگی سازمان مدیریت و برنامه ریزی کشور و در چارچوب بودجه‌های سنواتی از کمک‌ها و سایر منابع اعتباری وزارت ارتباطات و فناوری اطلاعات و سازمان‌ها و شرکت‌های تابع آن و سایر نهادها استفاده نماید.
ماده ۵ - تشکیلات سازمان پس از تدوین توسط سازمان و تایید سازمان مدیریت و برنامه‌ریزی کشور قابل اجرا خواهد بود.
ماده ٦- رییس سازمان که معاون وزیر ارتباطات و فناوری اطلاعات و دبیر شورایعالی فضایی می‌باشد، توسط وزیر ارتباطات و فناوری اطلاعات منصوب می‌شود و بالاترین مقام اجرایی دستگاه خواهد بود.
ماده ۷- رییس سازمان مسئول حسن اجرای امور و حفظ حقوق، منافع و اموال سازمان است و برای اداره امور سازمان و انجام مصوبات شورای عالی فضایی دارای همه گونه حقوق و اختیارات تام در حدود مقررات است و نمایندگی سازمان را در مقابل تمامی مقامات قضایی و اشخاص حقیقی و حقوقی با حق توکیل به غیر خواهد داشت و نیز می‌تواند قسمتی از اختیارات خود را به موجب ابلاغ کتبی به هر یک از معاونان، مدیران یا کارکنان سازمان به تشخیص و مسئولیت خود تفویض نماید.
این اساسنامه به موجب نامه شماره ۸٤/۳۰/۱۲٦۱۲ مورخ ۱۳۸٤/٤/۸ شورای نگهبان به تایید شورای یاد شده رسیده است.

2008

The Cabinet of the Islamic Republic of Iran in its meeting of June 16, 2008, according to proposal number 1/27560 of the Ministry of Communications and Information Technology dated August 9, 2007, and citing Article 9 of the Law for Tasks and Authorizations of the Ministry of Communications and Information Technology approved on December 10, 2003 by the parliament of the Islamic Republic of Iran, passed the statute of the Iranian Space Agency as follows:

STATUTE OF THE IRANIAN SPACE AGENCY

Article 1: Aiming at implementing its legal tasks and the study, research, design, engineering and execution of space services and remote sensing technologies, and strengthening the communication networks and space technology inside and out of the country, and the sovereign activities of the Iranian Remote Sensing Center and the Ministry of Communications and Information Technology, benefiting from the facilities and human resource of the Department of Design, Engineering and Installation of Satellite Communications and the Department of Maintenance of Satellite Communications both affiliated with the Telecommunications Company of Iran, the Iranian Space Agency which is briefly referred to as 'Agency' in this Statute, is established.

Article 2: As a legal entity, the Agency is a financially independent official foundation affiliated with the Ministry of Communications and Information Technology and it will be managed based on its specific financial and trade laws and regulations in the framework of the laws and regulations of the Islamic Republic of Iran.

Article 3: The agency's tasks and authorizations are as follows:

I Implement the study, research, designing, engineering and operating issues in the fields of space service technologies, remote sensing and strengthening the communications and space technology networks inside and outside of the

country as well as the sovereign tasks of the Iranian Remote Sensing Center and the Ministry of Communications and Information Technology.

II Prepare and regulate the mid-term and long-term programs for country's space sector in cooperation with related institutions for proposal to the relevant referents.

III Study for policy-making the design, manufacturing, launching and use of research and applied satellites and providing space services for proposal to the legally cognizable referents.

IV Research, design, manufacture and launch of commercial, scientific and research satellites, and design and establish a control center for the launch of national satellites in cooperation with related institutions.

Nota Bene: Excluding the launch and satellite control center, the abovementioned issues could be implemented by the non-governmental sector under the supervision of the Agency.

V Plan to conduct and develop the peaceful uses of outer space, celestial bodies, astronomy and space technology, strengthen national, regional and international communication networks operated by the state, cooperative and private sectors, and monitor their implementation in accordance with the policies of the country.

VI Study, research, develop technologies and apply specific education in the development of space science and technologies.

VII Study the requirements for conducting satellite and other space technology projects in accordance with related laws and regulations.

VIII Contribute to the implementation of the national, regional and international satellite projects in the framework of the major policies of the regime and other related laws and regulations.

IX Implement the assigned sovereign tasks through providing space sector signal (including voice, image and data) for the land sector applicants, issuing authorization of activities in space aimed at integral management of the country's space sector and the sustained and coordinated exploitation of space technologies and facilities including satellites, network of private or national satellites (including satellite mobile), direct receiving and transmitting stations, and satellite control in accordance with related rules and regulations.

X Get the approved tariffs for offering space services and issuing authorization for activities in space.

XI Assess the competence of non-governmental contractors and advisors for the implementation of space-related executive and research issues in different parts of the country in accordance with related laws and regulations.

XII Represent, nominate membership and attend related regional and international societies and unions aimed at protecting national interests in accordance with the regime's main policies and other laws and regulations.

XIII Implement regional and international cooperation programs in space issues in accordance with the regime's main policies.

XIV Manage and exploit satellite and orbital positions in coordination with responsible bodies and pursue their international registration for optimum use of space sources.

XV Study and plan for securing the space sector needs of the country's whole satellite networks for provide satellite services through the national, regional and international satellites in the framework of laws and regulations.

XVI Prepare the regulations and statutes related to the tasks in Article 9 of the Law for Tasks and Authorizations of the Ministry of Communications and Information Technology approved in 2003, for proposal to legal referents for approval.

XVII Establish a national archive for centralized storage, classification and updating of space data.

Nota Bene 1: The Agency is obliged to apply the highest capacity of the non-governmental sector in the framework of the major policies of the regime for implementing its tasks and affairs.

Nota Bene 2: Determining the security competence Clauses IX and XI in this article will be the responsibility of the related referents.

Nota Bene 3: The Agency is authorized to proceed in establishing space research centers and firms with the endorsement of the Council for Development of Higher Education in accordance with laws and regulations.

Nota Bene 4: Regarding Clause X, the Agency is obliged to act based on the rates approved by the Cabinet and settle the funds to the public revenue account (near the General Treasurer).

Article 4: The Agency's finances will be secured through public funds and credits in the country's annual budget and will be expended in the framework of the Agency's specific statutes subject to article 2 of this Statute and other related laws and regulations.

Nota Bene: In coordination with the Planning and Strategic Monitoring Deputyship of the President of the Islamic Republic of Iran, and in the framework of annual budgets, the Agency is authorized to make use of the financial allowance and other trust funds of the Ministry of Communications and Information Technology and its affiliated organizations and firms and other institutions.

Article 5: In implementing Clause 10 of Article 68 of the Law for Management of Country Service that was approved in 2007, the Agency, in coordination with the Management and Human Assets Development Deputyship of the President of the Islamic Republic of Iran, is authorized to make superior payments with the endorsement of the Cabinet to draw and retain appropriate human resources for the specialized and managerial positions.

Article 6: After formulation by the Agency and confirmation by the Management and Human Assets Development Deputyship of the President of the Islamic Republic of Iran, the organizational chart of the Agency will take effect.

Article 7: The president of the Agency, who will also be the Deputy Minister of Communications and Information Technology, will be appointed by that Minister and will hold the highest executive position at the Agency.

Article 8: In accordance with the full rights and authorizations in the framework of regulations, the president of the Agency will be responsible for managing the implementation of the decisions of the Space Supreme Council. The president will be responsible for protecting the rights, interests and assets of the Agency. The president can delegate authority with official notification, but will ultimately represent the Agency before all legal authorities.

According to letter number 87/30/27483 dated July 2, 2008, this Statute was passed by the Guardian Council of the Constitution of the Islamic Republic of Iran.

The Ministry of Communications and Information Technology was notified of this approval through letter number 62999 T 38571 H on July 15, 2008.

Persian text of the Statute of 2008

متن كامل اساسنامه سازمان فضايي ايران

سه شنبه، ۲۲ مردادماه ۱۳۸۷

ايتنا – هيئت وزيران در جلسه مورخ ۱۳۸۷/۳/۲۶ بنا به پيشنهاد شماره ۱/۲۷۵۶۰ مورخ ۱۳۸۶/۸/۹، وزارت ارتباطات و فناوري اطلاعات و به استناد ماده ۹ قانون وظايف و اختيارات وزارت ارتباطات و فناوري اطلاعات- مصوب ۱۳۸۲- اساسنامه سازمان فضايي ايران را به شرح زير تصويب كرد:

ماده يك - به منظور انجام وظايف قانوني و امور مطالعاتي، پژوهشي، طراحي، مهندسي و اجرا در زمينه فناوري‌هاي خدمات فضايي و سنجش از راه دور و تقويت شبكه‌هاي ارتباطي و فناوري فضايي در داخل و خارج از كشور و تجميع فعاليت‌هاي حاكميتي مركز سنجش از راه دور ايران و وزارت ارتباطات و فناوري اطلاعات، سازمان فضايي ايران كه در اين اساسنامه به‌اختصار سازمان ناميده مي‌شود، با استفاده از امكانات و نيروي انساني اداره كل طرح و مهندسي و نصب ارتباطات ماهواره‌اي و اداره كل نگهداري ارتباطات ماهواره‌اي شركت مخابرات ايران تشكيل مي‌شود.

ماده دو- سازمان داراي شخصيت حقوقي و استقلال مالي است و به صورت مؤسسه دولتي وابسته به وزارت ارتباطات و فناوري اطلاعات و براساس قوانين و آيين‌نامه‌هاي مالي و معاملاتي خاص خود و در چارچوب قوانين و مقررات، اداره خواهد شد.

ماده سه - وظايف و اختيارات سازمان به شرح زير است:

الف- انجام امور مطالعاتي، پژوهشي، طراحي، مهندسي و اجرا در زمينه فناوري‌هاي خدمات فضايي و سنجش از راه دور و تقويت شبكه‌هاي فضايي در داخل و خارج از كشور و تجميع فعاليت‌هاي حاكميتي مركز سنجش از راه دور ايران و وزارت ارتباطات و فناوري اطلاعات.
ب- تهيه و تنظيم برنامه‌هاي ميان‌مدت و درازمدت در بخش فضايي كشور با همكاري دستگاه‌هاي ذيربط براي پيشنهاد به مراجع ذيربط.
پ- انجام مطالعات به منظور تدوين سياست‌هاي طراحي، ساخت، پرتاب و استفاده از ماهواره‌هاي تحقيقاتي و كاربردي و ارايه خدمات فضايي براي پيشنهاد به مراجع ذيصلاح قانوني.
ت- انجام تحقيقات، طراحي، ساخت و پرتاب ماهواره‌هاي تجاري، علمي و تحقيقاتي و طراحي و ساخت مركز كنترل و پرتاب ماهواره‌هاي ملي با همكاري دستگاه‌هاي ذيربط.
تبصره- امور يادشده به جز پرتاب و مركز كنترل ماهواره‌اي مي‌تواند توسط بخش غيردولتي تحت نظارت سازمان انجام شود.
ث- برنامه‌ريزي به منظور هدايت و گسترش استفاده صلح‌آميز از فضاي ماوراي جو و اجرام سماوي و نجوم و فناوري فضايي، تقويت شبكه‌هاي ارتباطي ملي، منطقه‌اي و بين‌المللي توسط بخش‌هاي دولتي، تعاوني، خصوصي و نظارت بر اجراي آنها در چارچوب سياست‌هاي كلان كشور.
ج- مطالعه، پژوهش، توسعه فناوري و آموزش‌هاي كاربردي خاص در زمينه توسعه علوم و فناوري‌هاي فضايي.
چ- بررسي نيازها و اجراي پروژه‌هاي ماهواره‌اي و ساير فناوري‌هاي موردنياز براي توسعه فناوري فضايي در چارچوب قوانين و مقررات مربوط.
ح- مشاركت در اجراي پروژه‌هاي ماهواره‌اي ملي، منطقه‌اي و بين‌المللي در چارچوب سياست‌هاي كلي نظام و ساير قوانين و مقررات مربوط.
خ- اعمال وظايف حاكميتي محوله از طريق ارايه سيگنال بخش فضايي (اعم از صوت، تصوير و داده) به متقاضيان در بخش زميني، اعطاي مجوز براي فعاليت در فضا به منظور مديريت يكپارچه بخش فضايي كشور و بهره‌برداري منسجم و هماهنگ از فناوري و امكانات فضايي شامل ماهواره‌ها، شبكه ماهواره‌اختصاصي يا ملي (شامل موبايل ماهواره‌اي)، ايستگاه‌هاي اخذ مستقيم، ايستگاه‌هاي ارسال مستقيم و كنترل ماهواره‌ها در چارچوب ضوابط و مقررات مربوط.
د- دريافت تعرفه‌هاي مصوب عرضه خدمات فضايي و اعطاي مجوز فعاليت در فضا.
ذ- تعيين صلاحيت پيمانكاران و مشاوران غيردولتي براي انجام امور اجرايي و تحقيقاتي فضايي در بخش‌هاي مختلف

كشور در چارچوب قوانين و مقررات مربوط.
ر- نمايندگي، عضويت و حضور در مجامع و اتحاديه‌هاي منطقه‌اي و بين‌المللي مربوط بهمنظور حفظ منافع ملي در چارچوب سياست‌هاي كلي نظام و ساير قوانين و مقررات مربوط.
ز- اجراي برنامه‌هاي همكاري منطقه‌اي و بين‌المللي در امور فضايي در چارچوب سياست‌هاي كلي نظام.
ژ- مديريت و بهره‌برداري از موقعيت‌هاي مداري و ماهواره‌اي و هماهنگي با دستگاه‌هاي مسؤول و پيگيري براي ثبت بين‌المللي آنها به منظور استفاده بهينه از منابع فضايي.
س- مطالعه و برنامه‌ريزي براي تأمين بخش فضايي موردنياز تمام شبكه‌هاي ماهواره‌اي كشور به منظور ارايه خدمات ماهواره از طريق ماهواره‌هاي ملي، منطقه‌اي و بين‌المللي در چارچوب قوانين و مقررات.
ش- تهيه و تدوين مقررات و آيين‌نامه‌هاي مرتبط با شرح وظايف مندرج در ماده ۹ قانون وظايف و اختيارات وزارت ارتباطات و فناوري اطلاعات_ مصوب ۱۳۸۲- و پيشنهاد به مراجع قانوني براي تصويب.
ص- ايجاد باياگاني ملي و تمركز در نگهداري و طبقه‌بندي و بهنگام‌سازي اطلاعات فضايي.
تبصره ۱- سازمان موظف است، براي انجام امور و وظايف محول شده از حداكثر توان بخش‌هاي غيردولتي در چارچوب سياست‌هاي كلي نظام استفاده كند.
تبصره۲- مسؤوليت تعيين صلاحيت امنيتي در خصوص بندهاي «خ» و «ذ» اين ماده با مراجع ذي‌ربط خواهد بود.
تبصره۳- سازمان مجاز است به منظور انجام امور و وظايف محول با تأييد شوراي گسترش آموزش عالي كشور نسبت به تأسيس مركز تحقيقات فضايي (پژوهشكده يا پژوهشگاه) و نيز ايجاد شركت در چارچوب قوانين و مقررات، اقدام كند.
تبصره٤- در خصوص بند «د» سازمان مكلف است، براساس نرخ‌هايي كه به تصويب هيأت وزيران خواهد رسيد، اقدام و وجوه حاصل را به حساب درآمد عمومي(نزد خزانه‌داري كل) واريز كند. معادل صددرصد اعتبار يادشده از محل رديف اعتباري در قوانين بودجه در اختيار سازمان قرار مي‌گيرد تا پس از مبادله موافقتنامه با معاونت برنامه‌ريزي و نظارت راهبردي رييس جمهوري هزينه شود.

ماده چهار- اعتبار موردنياز سازمان در وجوه و اعتبارات عمومي‌بودجه سالانه كشور پيش‌بيني‌و تأمين مي‌شود و در چارچوب آيين‌نامه‌هاي خاص سازمان موضوع ماده ۳ اين اساسنامه و ساير قوانين و مقررات مربوط هزينه خواهد شد.
تبصره- سازمان مي‌تواند با هماهنگي معاونت برنامه‌ريزي و نظارت راهبردي رييس جمهوري و در چارچوب بودجه‌هاي سنواتي از كمك‌ها و ساير منابع اعتباري وزارت ارتباطات و فناوري اطلاعات و سازمان‌ها و شركت‌هاي تابع آن و ساير نهادها استفاده كند.

ماده پنج- در اجراي بند۱۰ ماده ٦٨ قانون مديريت خدمات كشوري- مصوب ۱۳۸٦- سازمان مي‌تواند با هماهنگي معاونت توسعه مديريت و سرمايه انساني رييس جمهوري، به منظور جذب و نگهداري نيروهاي مناسب براي مشاغل تخصصي و مديريت، فوق‌العاده لازم با تصويب هيئت وزيران پرداخت كند.

ماده ششم- تشكيلات سازمان پس از تدوين توسط سازمان و تأييد معاونت توسعه مديريت و سرمايه‌انساني رييس جمهوري قابل اجرا خواهد بود.

ماده هفت- رييس سازمان كه معاون وزير ارتباطات و فناوري اطلاعات است، توسط وزير يادشده منصوب مي‌شود و بالاترين مقام اجرايي دستگاه خواهد بود.

ماده هشت- رييس سازمان مسئول حسن اجراي امور و حفظ حقوق، منافع و اموال سازمان است و براي اداره امور سازمان داراي همه گونه حقوق و اختيارات تام در حدود مقررات است و نمايندگي سازمان را در مقابل تمام مقام‌هاي قضايي و اشخاص حقيقي و حقوقي با حق توكيل به غير خواهد داشت و نيز مي‌تواند قسمتي از اختيارات خود را به موجب ابلاغ كتبي به هر يك از معاونان، مديران يا كاركنان سازمان به تشخيص و مسؤوليت خود تفويض كند.

اين اساسنامه به موجب نامه شماره ۸۷/۳۰/۲۷٤۸۳ مورخ ۱۳۸۷/٤/۱۲، شوراي نگهبان به تأييد شوراي يادشده، رسيده است.

اين مصوبه با شماره ٦۲۹۹۹ ت۳۸۵۷۱ هـ در تاريخ ۱۳۸۷/٤/۲۵، به وزارت ارتباطات و فناوري اطلاعات ابلاغ شده است.

Abbreviations

3-D	Three Dimensional
AA	Aram Azmoon
AARS	Asian Association on Remote Sensing
ACSF	Air Charter Safety Foundation
AICTRC	Advanced Information and Communication Technology Research Center
AIO	Aerospace Industries Organization [of Iran]
ANDT	Aviation Non-Destructive Testing
AP-MCSTA	Asia-Pacific Multilateral Cooperation on Space Technology Applications
APRSAF	Asia-Pacific Regional Space Agency Forum
APSCC	Asia-Pacific Satellite Communications Council
APSCO	Asia-Pacific Space Cooperation Organization
AREO	Agricultural Research and Education Organization
ARI	Aerospace Research Institute
ARI	Astronautics Research Institute
ASAR	Advanced Synthetic Aperture Radar
ASAT	Anti-SATellite [weapons]
ASC	Alborz Space Center
ASDC	Aerospace System Design Competition
ASI	Astronomical Society of Iran
ASM	Asian Surveying and Mapping
ASRA	Applied Science and Research Association
ASRJ	*Advances in Space Research Journal*
ASTER	Advanced Space borne Thermal Emission and Reflection Radiometer
ASTM LSA	American Society for Testing and Materials- Light Sport Aircraft
AUT	Amir-Kabir University of Technology
AVHRR	Advanced Very High Resolution Radiometer
AWiFS	Advanced Wide Field Sensor
BRCSR	Bureau for Research and Coordination of Safety and Reconstruction Affairs
BSS	Broadcasting Satellite Service
CAIS	Circle of Ancient Iranian Studies
Caltech	California University of Technology

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CATC	Civil Aviation Technology College
CCD	Charge-Coupled Device
CEAS	Center for Excellence in Aerospace Systems
CEO	Chief Executive Officer
CERN	Centre Européenne pour la Recherche Nucléaire
CFD	Computational Fluid Dynamics
CGSC	Carlo Gavazzi Space Company
CGT	Cie General de Transport
COMSTECH	Committee on Scientific and Technological Cooperation
COPUOS	Committee on the Peaceful Uses of Outer Space
COSPAR	Committee on Space Research
CRA	Communications Regulatory Authority
CRTEAN	Centre Régional de Télédétection des Etats d'Afrique du Nord
CSM	Communication System Monitoring
CSSTE-AP	Centre for Space Science and Technology Education in Asia and the Pacific
CS-VLA	Certification Specification for Very Light Aircraft
CTA	Constant-Temperature Anemometer
CTA	Constant-Temperature Anemometer
DEM	Digital Elevation Model
DInSAR	Differential InSAR
DIO	Defense Industries Organization
DOA	Design Organization Approval Certificate
DS InSAR	Distributed Scatterer InSAR
DSAS	Deputyship of the Space Applications and Services
DSM	Digital Surface Model
DSO	Day Sight Optics
DTM	Digital Terrain Model
DVB-S	Digital Video Broadcasting-Satellite
EAERI	East Azerbaijan Engineering Research Institute
EASA	European Aviation Safety Agency
ECEDEP	Electrical and Computer Science Engineering Department
ECG	Electrocardiogram
ECI	Electronic Components Industries
EEG	Electroencephalogram
ERI	Engineering Research Institute
ERTS	Earth Resource Technology Satellite
ESA	European Space Agency
ESCAP	Economic and Social Commission of Asia and the Pacific
ESRIN	European Space Research Institute
ETM	Enhanced Thematic Mapper
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EUTELSAT	European Telecommunications Satellite Organization
FAI	Fédération Aéronautique Internationale

FAR Part-23	Federal Aviation Regulations Part-23
FCC	Flight Control Center
FERI	Fars Engineering Research Institute
FPP	Freefall Personnel Parachute
FRWO	Forests, Rangelands and Watershed Management Organization
FSS	Fixed Satellite Service
FY-2	Feng Yun-2
GC	Guardian Corps of the Islamic Revolution
GCS	Ground Control System
GE	General Electric [Co.]
GEO	GEostationary Orbit
GIS	Geographical Information System
GMPCS	Global Mobile Personal Communications by Satellite
GMPCS	Globalstar and the global Mobile Personal Communications by Satellite
GODDSN	General Office of Design and Development of the Satellite Networks
GOOMGS	General Office of Operating and Maintenance of the Ground Stations
GOSSRS	General Office of the Space Services and Remote Sensing
GPS	Global Positioning System
GRAIL	Gravity Recovery and Interior Laboratory
GSI	Geological Survey of Iran
HF	High Frequency
HRV	High Resolution Visible
HRPT	High Resolution Picture Transition
HRVIR	High Resolution Visible and Infrared
IACI	Iranian Aircraft Industries [SAHA in Persian]
IAFAIO	Iranian Armed Forces Aviation Industries Organization
IAIO	Iran Aviation Industries Organization
IAMI	Iran Aircraft Manufacturing Industries Corporation [HESA in Persian]
IAS	Iranian Aerospace Society
IASBS	Institute for Advanced Studies in Basic Science
IASIA	Iran Aviation and Space Industries Association
IATA	International Air Transport Association
IAU	International Astronomical Union
ICC	Iran Can-Sat Competition
ICI	Iran Communication Industries
ICO	Intermediate Circular Orbit
ICS	International Council for Science
ICSHTES	International Center for Science and High Technology and Environmental Science
ICSU	International Council of Scientific Unions
IDNDR	International Decade For Natural Disaster Reduction
IEI	Iran Electronics Industries
IERC	Iran Electronics Research Center

IERI	Isfahan Engineering Research Institute
IHSRC	Iran Helicopter Support and Renewal Company [PANHA in Persian]
IHU	Imam Hussein University
IIAR	Iranian Institute of Applied Research
IKIU	Imam Khomeini International University
IKLC	Imam Khomeini Launch Center
IMSO	Convention of the International Mobile Satellite Organization
INIO	Iranian National Institute for Oceanography
INO	Iranian National Observatory
InSAR	Interferometric SAR
Intelsat	International Telecommunications Satellite Organization
IOI	Isfahan Optics Industries
IOR	Indian Ocean Region
IOTA	International Occultation Timing Association
IOTA-ME	International Occultation Timing Association, Middle East
IR Iran	Islamic Republic of Iran
Iran-SPCA	Iranian Society for the Prevention of Cruelty to Animals
IRBM	Intermediate-Range Ballistic Missile
IRFS	Institute for Research in Fundamental Sciences
IRIB	Islamic Republic of Iran Broadcasting Organization
IRILV	Islamic Republic of Iran Launch Vehicle
IRIMO	IR Iran Meteorological Organization
IROST	Iranian Research Organization for Science and Technology
IRS	Indian Remote Sensing [Satellite]
IRTO	Iran Technical Organization
ISA	Iranian Space Agency
ISIG	Iran Space Industries Group
ISIRAN	Information Systems of Iran
ISNA	Iranian Students' News Agency
ISNET	Inter-Islamic Network on Space Sciences and Technology
ISPRS	International Society of Photogrammetry and Remote Sensing
ISRSE	International Symposium on Remote Sensing of Environment
ISTPM	Institute for Studies in Theoretical Physics and Mathematics
ISWA	International Science Writers Association
ITMC	Iran Telecommunication Manufacturing Company
ITRC	Iran Telecommunications Research Center
ITSO	International Telecommunications Satellite Organization
ITU	International Telecommunication Union
IUST	Iran University of Science and Technology
IYA-2009	International Year of Astronomy-2009
JAR23	Joint Aviation Regulations-23
JAR-VLA	Joint Aviation Regulations-Very Light Airplane
JERS-1	Japanese Earth Resources Satellite1
JICA	Japan International Cooperation Agency
JPL	Jet Propulsion Laboratory

JSST	*Journal of Space Science and Technology*
KNUT	Khajeh Nasir-e Tusi University of Technology
kph	Kilometers per hour
LEO	Low-Earth orbit
LHC	Large Hadron Collider
LISS	Linear Imaging Self-Scanning [System]
LRF	Laser Range Finders
MATI	Moscow Aerospace Technology University
MATU	Malek Ashtar Technical University
MCIT	Ministry of Communications and Information Technology
MDO	Multidisciplinary Design Optimization
MIR	Mid-Infrared
MODAFL	Ministry of Defense and Armed Forces Logistics
MODIS	Moderate Resolution Imaging Spectro-radiometer
MOI	Ministry of Interior
MPTT	Ministry of Post, Telegraph and Telephone
MSC	Mahdasht Space Center
MSRI	Mazandaran Space Research Institute
MSRS	Mahdasht Satellite Receiving Station
MSRT	Ministry of Science, Research and Technology
MSS	Multi-Spectral Scanner
MTC	Mobile Telephone Center
MUT	Malek Ashtar University of Technology
NARSS	National Authority for Remote Sensing and Space Sciences
NASA	National Aeronautics and Space Administration
NCC	National Cartographic Center
NCNDR	National Committee for Natural Disaster Reduction
NCPDSISA	National Committee for Preparing the Draft of the Statute of the Iran's Space Agency
NDMO	National Disaster Management Organization
NDT	Non-Destructive Tests
NDTF	National Disaster Task Force
NEO	Near Earth Object
NGO	Non-Governmental Organization
NIRT	National Iranian Radio and Television
NOAA	National Oceanic and Atmospheric Administration
NTBT	Nuclear Test Ban Treaty
NVS	Night Vision System
OIC	Organization of Islamic Conference
OPM	Oversize Primary Mirror
PA	Production Approval [Certificate]
PAAIA	Public Affairs Alliance of Iranian Americans
Pan	Panchromatic
PAS	Persian Air Service
PCSR	Permanent Committee on Space Radiations

PEEMFRL	Power Electronics, Electrical and Magnetic Fields Research Laboratory
PETA	People for the Ethical Treatment of Animals Foundation
PMO	Ports and Maritime Organization
PPEC	Permanent Periodic Error Correction
PPT	Pulsed Plasma Thruster
PS InSAR	Persistent Scatterer InSAR
PSI	Physical Society of Iran
RBV	Return Beam Vidicon
RESAP	Regional Program on Space Technology Applications
RHUDRC	Road, Housing and Urban Development Research Center
RIAAM	Research Institute for Astronomy and Astrophysics of Maragheh
RIAPA	Research Institute for Applied Physics and Astronomy
RISST	Research Institute of Space Science and Technology
RS	Remote Sensing
SAIran	Iran Electronics Industries Organization
SAR	Synthetic Aperture Radar
SAT NAV	SATellite NAVigation
SBIG	Shahid Bagheri Industrial Group
SBU	Shahid Beheshti University
SCIT	Security of Communication and Information Technology
SCP	Strato Cloud Parachute
SCWMRI	Soil Conservation and Watershed Management Research Institute
SEI	Shiraz Electronics Industries
SESAME	Synchrotron Light for Experimental Science and Applications in the Middle East
SIGINT	SIGnals INTelligence
SLC	Semnan Launch Center
SLCI	Single Look Complex Image
SLV	Satellite Launch Vehicle
SMMS	Small Multi-Mission Satellite
SPOT	Système Pour l'Observation de la Terre
SRBIAU	Science and Research Branch of the Islamic Azad University
SRC	Space Research Center
SRI	Space Research Institute
SRRI	Shahid Rezaie Research Institute
SRTM	Shuttle Radar Topography Mission
SSC	Space Supreme Council
SSH	Sazemane Sanaye Hava-Faza
STBInSAR	Short Temporal Baseline SAR Interferometry
STI	Security of Telecommunication and Information Technology
STS-COPUOS	Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space
SUPARCO	[Pakistan] Space and Upper Atmosphere Research Commission
SUT	Sharif University of Technology

SUTECH	Shiraz University of Technology
SVISSR	Stretched Visible and Infrared Spin Scan Radiometer
TC	Type Certificate
TCI	Telecommunication Company of Iran
TDMA	Time Division Multiple Access
TDMMO	Tehran Disaster Mitigation and Management Organization
TLSM	Technical Laboratory of Soil Mechanics
TM	Thematic Mapper
TMU	Tarbiat Modarres University
TNO	Trans Neptunian Object
TOA	Trans Ocean Airlines
TRC	Telecommunications Research Center
TT&C	Telemetry, Tracking and Command
TWA	Trans World Airlines
TWAS	Third World Academy of Science
UAV	Unmanned Aerial Vehicle
UHF	Ultra High Frequency
UHTC	Ultra High Transmission Coatings
UI	University of Isfahan
UL/LSA	Ultra-Light/Light Sport Aircraft
UN-COPUOS	United Nations Committee on the Peaceful Uses of Outer Space
UNIDROIT	International Institute for the Unification of Private Law
UNISPACE-82	United Nations Second International Conference on the Exploration and Peaceful Uses of Outer Space, 1982
UNISPACE-III	United Nations Third International Conference on the Exploration and Peaceful Uses of Outer Space
UN-OOSA	United Nations Office for Outer Space Affairs
UN-SPIDER	United Nations Space-based Platform for Disaster Management
USA	United States of America
USC	University of South California
USSR	Union of Soviet Socialist Republics
UT	User Terminal
VHF	Very High Frequency
VSAT	Very Small Aperture Terminal
WiFS	Wide Field Sensor
WSW	World Space Week
WZNW	Wess-Zumino-Novikov-Witten
WZW	Wess-Zumino-Witten
ZISM	Zero Image-Shift Micro-focuser

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About the author

The Space Age began on October 4, 1957 with the launch of Sputnik, the first man-made satellite, by the Soviet Union. About three years later, I was born on Sunday, August 21, 1960 into a middle class family in Maragheh, a city in the northwest of Iran and famous for its ancient observatory and Khajeh Nasir al-Din al-Tusi, the founder of the observatory. From the early days of my childhood, my father tried to acquaint me with the celestial bodies in the night sky. Listening to his explanations about the strange phenomena in space were wonderful and fascinating times and are now fond memories. As a teacher when he was young, my father was prohibited to continue working following the coup d'état of 1953 in Iran. He worked in the Notary Publics of Maragheh until he retired. Although a diligent fellow, eager to study, obstacles and shortages in his youth prevented him from finishing his higher education. I did my primary level studies at the Badr Primary School from 1966 to 1970. Later from 1971 to 1973, I did my middle level studies at Shafagh Middle School. My secondary school studies were at the Pahlavi High School from 1974 to 1977, just before the onset of the revolution in Iran. Both Badr and Shafagh were state schools for the education of children of middle class families in Maragheh. There was only one high school in the city in which boys could study mathematics and physics, and that was the one I went to.

The history of my birthplace has always excited me, particularly the remnants of the observatory some 2km outside the city, at the top of a hill in the west called Talebkhan. When I was a teenager, I always walked from home to the hill. It was a great amusement for me for a long while. I had the opportunity to exercise both physically and mentally. This son of the Space Age two decades later became the youngest member of the Bureau of the United Nations Committee of Peaceful Uses of Outer Space (COPUOS), and the first Iranian to serve in this capacity. In June 2003, I was chosen by the COPUOS members to work in the capacity of Second Vice Chairman of the Committee from 2004 to 2006. I believe that my wonderful birthplace and my father were the key and effective factors in directing me to such a career of space science and technology, which I selected through studying physics at Tehran and Knightsbridge universities. I left my birthplace for higher education studies at 18 and began to study physics at the University of Tehran, the best-qualified place in the country for studying physics. Although I have had the opportunity to visit Maragheh once or twice a year since then, my memories remain sharp and my interest is ever more enhanced. I believe that Maragheh has actually been the gateway for my progress and advancement.

P. Tarikhi, *The Iranian Space Endeavor: Ambitions and Reality*, Springer Praxis Books,
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My father, Ahmad Tarikhi (b.1925), played a key role in stimulating my interest in space. [Author]

NATURE, CULTURE AND SOCIETY AND HISTORY OF MY BIRTHPLACE

At an elevation of 1,619m above sea level, Maragheh is a city with about 248,000 inhabitants in the East Azerbaijan Province. It is an ancient city situated in a narrow valley which runs nearly north to south on the southern slopes of Mount Sahand, whose ridge is 3,722m above sea level and protects Maragheh from the harsh winter coldness experienced in Tabriz.

The city is situated at the eastern extremity of a well-cultivated plain which opens toward Lake Urmieh, some 22km to the west. Maragheh is on the bank of the Safi Chai River and surrounded by vineyards and orchards that are watered by canals from the river and produce great quantities of fruit. It is the trade and transportation center for exporting both fresh and dried fruits. The hills west of the town consist of horizontal strata of sandstone covered by irregular pieces of basalt. For more than a decade, the Alavian Dam to the northwest of the town has acted as a reservoir for the water from Safi Chai. Maragheh is linked by road to Tabriz 130km north, and Teheran 535km east. The railway has been the traditional means of travel between Maragheh, Tabriz, Tehran and other cities in this region. The airport at Maragheh receives only a couple of flights weekly from Tehran and vice versa.

My birthplace is very rich in natural and cultural resources. In the central part of the city, the old architectural structures were preserved for years but in very recent times the increase in land and real estate prices has persuaded owners of the old constructions to rebuild the houses in a new fashion and change the pattern of settlement. The tranquility

A distant view of Mount Sahand to the northeast of Maragheh. [Iran Map]

A distant view of Maragheh. [Auoob Farabi @ Mihanblog]

and privacy of the old houses, with their great yards of green plants, flowers and fruit trees, provide wonderful moments especially at dawn and late in the evening to relax, enjoy and think about the beauty and charm of life and existence. This is a specific and frequent memory of mine in addition to other sweet and wonderful memories of when I was living there during my childhood and teenage years.

In the 7th century, the region of Maragheh was conquered by Arab Muslims. During the liberation battles of Babak Khorramdeen with the Arabs, the town was the headquarters of the Arab army. After the Arab conquest, Maragheh developed rapidly as a provincial capital. In 1029 it was seized by the Oghuz Turks (Saljughs) who developed it into an important city, but a Kurdish chief who established a local dynasty drove them

A view of the Maragheh Observatory settling over the hill Talebkhan. [Reza Effati @ Panoramio]

In front of the dome-framed shelter of brass that protects the remnants of the observatory at Maragheh during an exploratory visit in the summer of 2007; from left to right are the author's wife, a relative, and the author. [Author]

out. The Mongols destroyed the city in 1221, but Hulaku Khan held court there until the establishment of a fixed capital at Tabriz. Maragheh's firm connection with the Mongol dynasty made it the capital of Azerbaijan for some time, presumably due to the excellent grazing for their countless horses. In 1256 Maragheh was selected by Hulaku Khan (1217-1265) as the capital of the Ilkhanate Empire ruling over most of Persia. Shortly thereafter it became the seat of the Church of the East Patriarch Mar Yaballaha III. Between 1259 and 1262, a university and an observatory were built near the town for Khajeh Nasir al-Din al-Tusi.

THE NARRATIVE OF A FORMATION

As a teenager, thinking about my future career, I was convinced that I would either be a forester or a physicist. This interest meant that I paid more attention to physical science, and I continued my high school studies in mathematics and physics. When I was going to conclude my studies in high school, a revolution in Iran took place in 1978. This was victorious early the next year, and changed a great many norms. I remained eager to continue my studies in physics. The universities were closed for a year because of the revolution but in 1979 I was admitted with high scores in the national entry exam to study physics at the University of Tehran. Prior to this, I had been in correspondence with Kamran Kaviani, a member of an amateur astronomical society based in Tehran and also a student of physics at the same university. Kamran was a year older than me and entered the university a year before me. On completing his studies in physics in Iran he obtained a PhD degree in physics and became a university professor. He was very clever and a serious person. When I joined him at the university, he persuaded me to follow the subjects of astronomy and space. Afterwards I eagerly studied the various aspects of space in the books and magazines available in the media and the library of the university.

The Physics Group of the University of Tehran at that time, was the topmost among the Iranian universities offering physics courses. One year after the reopening of the universities, the so-called Cultural Revolution was officially announced by the newly established government. It was indeed a messy situation in the country. The universities were closed by the bayonet and violence. An era of horror was systematically pursued throughout the country. In that period the Tehran embassy of the United States of America was occupied, the war

In the name of God

Verdict of the Central Admission Council
(This verdict is implicit and unrehearable)

[emblem]
Islamic Republic of Iran
Ministry of Culture and Higher Education
Central Admission Council

Date: September 2, 1984
No.: 2-5593/C.A.C
Enclosure: ---------

Mr. Jalme Parviz Tarikhi
The physics student of Tehran University,

Following investigation of your protest and its enclosures as well as the file received from Tehran University;
hereby we acknowledge that the verdict of the Admission Council of Tehran University about you
according to: the paragraph B of Item 1 of the Statute for Admission of University Students is confirmed.
And citing to:

☒ Report of the Investigation Team and the view of the Admission Council of Tehran University
☐ Available documents
☒ The view of the judicial and disciplinary bodies and organizations
☒ Witnesses of certitude of the Admission Council of Tehran University
☐ You confession

you are not allowed to continue your higher education studies.
Moreover, according to the Statute for Admission of University Students approved by the Cultural Revolution Headquarters that has notified the Central Admission Council by the letter number 172/M dated 17 April 1983 of the Ministry of Culture and Higher Education, you are not allowed to request for a certificate according to the regulations for awarding the equivalent post-diploma and or bachelor degree to the university students approved by the Cultural Revolution Headquarters on 13 September 1982.

Central Admission Council
[signed and sealed]

cc: the Honorable Chancellor of Tehran University

The interim official verdict prohibiting me from continuing my studies for a bachelor's degree in physics at the University of Tehran; the unofficial translation of the verdict made by the author is seen at right. [Author]

محرمانه

محرمانه

In the name of God

[emblem]
Islamic Republic of Iran
Ministry of Culture and Higher Education

No.: 1045/C.D.K
Date: June 16, 1986
Enclosure: ----------
Unit: ----------
Confidential
****

CONFIDENTIAL

Honorable Chancellor of Tehran University

Hereby we acknowledge that the case of Mr./~~Mme~~ Parviz Tarikhi, son of Ahmad, the Physics student of Tehran University, was adjudicated by the Central Disciplinary Committee of the University Students on June 14, 1986, and he is recognized as ineligible to continue his university studies. The result is acknowledged for necessary prosecutions.
It is evident that this verdict is implicit and unrehearable, and no objection will be accepted.

Central Disciplinary Committee of the University Students
[signed and sealed]

cc:
1) for the attention of the student Parviz Tarikhi
2) for the attention of the Disciplinary Committee of Tehran University
3) for insertion in the student's dossier

The final official verdict prohibiting me from continuing my studies for a bachelor's degree in physics at the University of Tehran; the unofficial translation of the verdict made by the author is seen at right. [Author]

between Iraq and Iran began, and there were mass state executions of dissidents. I was a witness to these unfortunate and unfavorable events, and was suffering like many other university students of Iran. After about two years the universities began to reopen gradually and sporadically. But under the new restrictive discipline imposed by the government, many of the best professors and tutors had either been dismissed or had emigrated, along with other specialists and technocrats. This exodus left the nation in the hands of incompetent, non-qualified and uneducated authorities who were taking their place increasingly and gradually day after day. However, when my faculty at the University of Tehran reopened in 1981, surprisingly and for no clear reason I was not permitted to continue my interrupted studies; it was really a bad fortune. In practice, there was no accusation, because I had never committed any offence. My only fault was that I had been beaten by the rascals and villains during the aggression of the government-supported gangs at the university on May 4, 1980. The self-styled Islamic government forbade me to continue my academic studies under the alleged Cultural Revolution plan, according to the verdicts issued to me on September 2, 1984 and June 16, 1986 respectively. It was really a nightmare; however, I was not unique because many university students were similarly penalized.

I left the capital and returned to my parental home in Maragheh, where I remained for more than five years. Those years were one of the darkest times in my life. The tumult of shortsightedness was predominant, with no prospect of it drawing to an end. I tried to overcome this unfortunate situation by setting a program to work, study and advancement. Through self-training, I committed to learn the French language and after a while I was translating scientific French books, initially in mathematics and then physics.

After five years, state reformist decisions allowed me conditionally to complete my interrupted studies for a bachelor's degree in physics. At that time I was doing military

In the name of God

[emblem]
Islamic Republic of Iran
Ministry of Culture and Higher Education
Central Board for Student Selection

Date: October 7, 1991
No.: 2/3100
Enclosure: ----------
Unit: ----------

Nominee, Mr. Parviz Tarikhi

With salutation,

Respectfully, referring to your request for revision concerning your domestic university entrance examination for Master of Science degree for the year 1369-1370 (1990-1991), hereby we acknowledge that your file was reinvestigated again and according to the approved criteria of the Supreme Council of Cultural Revolution you are not recognized as eligible [to continue your studies for a M.Sc. degree].

And success is from God
Secretariat of the Central Board for Student Selection

[sighed and sealed]
Amin Naimaie Aali

The official verdict prohibiting my study for a master's degree in physics issued by the Ministry of Culture and Higher Education; the unofficial translation of the verdict made by the author is seen at right. [Author]

service in Tehran, which had started early in 1987. The war between Iran and Iraq was continuing severely and with great and terrible causalities. Because my younger brother was in military service in the Iran-Iraq battles, I was exempted from this horror and instead I spent several months in a garrison next to a camp of the Iraqi prisoners of war in the south of Tehran. I was later dispatched to another garrison to the northeast of Tehran. When I had only 25 days of military service left, I was authorized to continue my interrupted study at the University of Tehran. But as soon as I resumed my studies the universities were forcibly closed once again, this time because of the risk of attacks by the Iraqi army on the capital and other strategic cities throughout the country. Half a year later, the universities reopened and I was able to continue. After gaining my bachelor's degree in 1991, I unsuccessfully attempted to participate in the national entrance exam for a master's degree in physics. I later learnt that I had been authorized only to finish my studies for a bachelor's degree and there was a prohibition on following through with a master's and doctoral degrees in my homeland.

This ruling was very cruel and unjust. Remembering that bitter situation is annoying, horrible and unfavorable to me. There was no possibility for me to continue my studies at a higher academic level in Iran. Although the war with Iraq was over, the country was in a terrible state, with people subject to tortures, punishments, deprivations, limitations, and discrimination. Family hurdles and the financial situation meant that I could not leave my homeland in order to study abroad, so I remained to attempt to change things. Nevertheless, I sought a means to continue my studies. After a lot of investigation, I chose a distance learning program at Knightsbridge University in England. In the middle of the 1990s the political and social environment in Iran finally began to lose its fanaticism. The Iranian

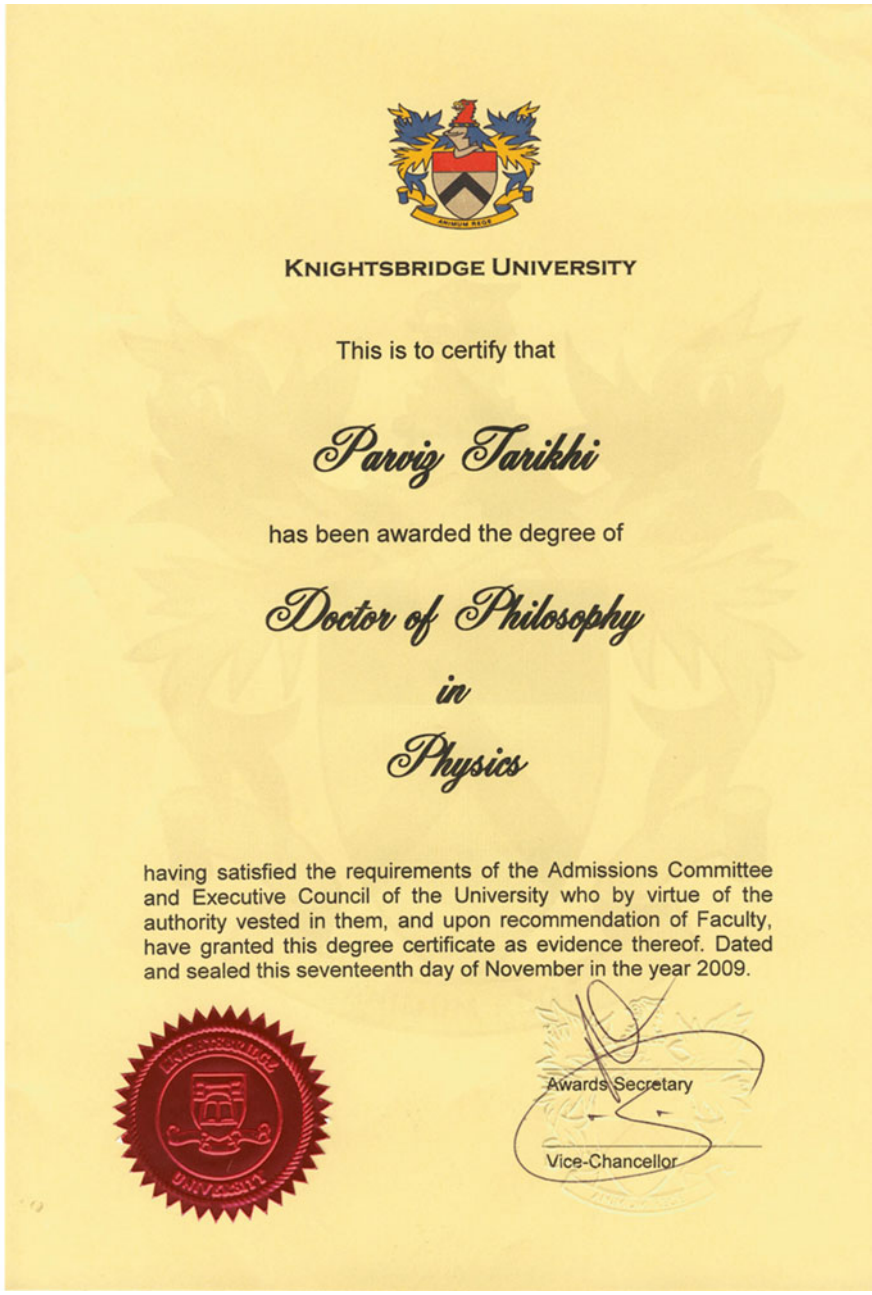
Remote Sensing Center (IRSC) affiliated to the Ministry of Post, Telegraph and Telephone employed me in September 1992. The IRSC became the foundation pillar of the Iranian Space Agency (ISA) that was established in February 2004 under the Ministry of Communications and Information Technology, in the process taking over all of the functions of the IRSC as well as several other space-related bodies. I gained some good achievements there. However, I was never authorized to continue my higher level studies in my homeland. I therefore developed my work and study by myself. I have always believed in my obligation to my nation and humanity. Even as the first Iranian appointed to the Bureau of UN-COPUOS since its establishment in 1958, I always followed this idea. COPUOS remains the highest international body involved in the application of space for peaceful purposes.

Unfortunately, as in the early couple of decades after the revolution of 1978, since 2005 personal and bigoted ideological loyalty has been valued over competence. The nightmare started to emerge again, influencing even selection of individuals for occupying official (and even unofficial) positions and capacities at all levels throughout the country. The Empire of Dissimulation and Imposture was spreading its octopus-like arms all across the land. Since then, this has threatened the security of the citizens mentally, socially, financially and physically, and has deeply corrupted Iranian society. This means that to remain honest, clean and safe in this closed community, one must bear a very dreadful pressure without any shelter and support. It is the situation for the individual that intends to live free, honest and clean; it is a great regret indeed. I have faced lots of discrimination, limitations and losses as this situation developed.

Working with Knightsbridge University was not easy and not a comfortable job for me. In fact, it was probably much harder than leaving the country and settling abroad to study and live. I gained my master of science degree in April 1999. Then in June 2000, I began the greater task of working for a doctorate in physics.

For my doctoral thesis I selected radar interferometry, in particular a precise method for measuring the surface displacements and generating 3-D models of land features. I began under the tutorship of Dr. Christopher Brindle, but because of his involvements and limitations I was reassigned to Professor Jerry D. Brown, a NASA scientist who was at the time president of the non-governmental organization Foundation of Discovery. It took me eight years to fully research the subject and, in conjunction with a colleague at IRSC and then ISA, I applied synthetic aperture radar (SAR) interferometry techniques to detect tiny changes on Earth from space. In November 2008, I finalized preparing my thesis according to the guidance, supervision, and comments of my tutor, and based on the agreed outline proposed by me. It reflected the contribution that I made to the subject of my dissertation in the course of work and overall experience since 1994. My thesis was approved in November 2009. To follow up on this work, in 2010 I started studying the less explored subject of Short Temporal Baseline InSAR and specifically the application of SAR Interferometry for aquatic bodies, so-called Liqui-InSAR.

I must express my deep appreciation to Knightsbridge University, and particularly its chancellor, for supporting me for several years and providing me with the opportunity to carry out my thesis for a doctoral degree in physics. However, it is worth pointing out that



KNIGHTSBRIDGE UNIVERSITY

This is to certify that

Parviz Tarikhi

has been awarded the degree of

Doctor of Philosophy

in

Physics

having satisfied the requirements of the Admissions Committee and Executive Council of the University who by virtue of the authority vested in them, and upon recommendation of Faculty, have granted this degree certificate as evidence thereof. Dated and sealed this seventeenth day of November in the year 2009.

Awards Secretary

Vice-Chancellor

The certificate of the author's PhD degree in physics. [Author]

I conducted that solemn, vigorous, and genuine job for about eight years in a realm that, despite its undeniably glorious past, now grants permission to study at postgraduate level as a reward on a basis other than objective eligibility, often excluding those imbued with the free-thinking spirit of scientific research. In pursuing my studies at Knightsbridge University, which has now relocated to Denmark, the authorities in Iran prohibited me from accessing scientific sources. None of the people whose assistance I sought in gaining access to the books suggested by my tutor consented to do so. Even in the latter years of preparing my thesis, communicating with my tutor abroad was very difficult. I conducted my task in a homeland ruled by the Empire of Dissimulation and Imposture, in which comfort, convenience and luxuriating in social endowments is unfortunately only being provided to people who display servility, deny justice, and reject integrity. However, I do believe that accomplishment, gentility and percipience will triumph. I have always attempted to be deserving of it. I feel myself at the beginning of a long, astonishing and wonderful path to satisfying accomplishment. Hopefully, future generations living in more fortunate times will find the miseries and injustice that befell me to be unimaginable. I have been deprived of the basic rights of a human being to benefit from a righteous and healthy community. I was unable to leave my country for higher education, but I am proud that despite the difficulties, strict limitations, and discriminations imposed upon me, I benefited from the opportunity to study for a PhD degree in physics.

TIME RUNS ALWAYS AND AWAITS NO-ONE

I am now a space science and technology senior expert, still affiliated with the Iranian Space Agency (ISA) in pursuance of the work of the former Iranian Remote Sensing Center (IRSC). I was based in Tehran from 1991 to 2004. Holding a PhD in physics, I am also a researcher, freelance journalist and technical writer. From June 2004 to June 2006, I worked as the UN-COPUOS Bureau member in the capacity of Second Vice Chairman and Rapporteur. Although this responsibility ended in June 2006, my membership in Group-15 consisting of past, current and future COPUOS Bureau members lasted until June 2008. From 2001 to 2007, I also chaired Action Team No.1 of the Recommendations of the United Nations Third International Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE-III) with the mission to develop a comprehensive worldwide environmental monitoring strategy. In addition to international activities related to COPUOS at the global level, I was involved with the UN-ESCAP Regional Space Applications Program (RESAP) and AP-MCSTA Asia-Pacific Space Cooperation Organization (APSCO) initiatives at regional level. From 2002 to 2007, I led the Office for Specialized International Cooperation of the former IRSC and then ISA. Despite the fact that I have worked actively for many years in international and official capacities and positions, the ISA authorities have excluded me from key positions in the agency since 2007. I have been mainly involved with self-supported and oriented research and development on microwave remote sensing and studying the developments and status of space science and technology at what is now known as the Alborz Space Center.

Having specialized in radar remote sensing since 1994, I am now well experienced in the analysis of satellite Earth resources data, in particular synthetic aperture radar (SAR)

The author working in the capacity of a member of the COPUOS Bureau. [Author]

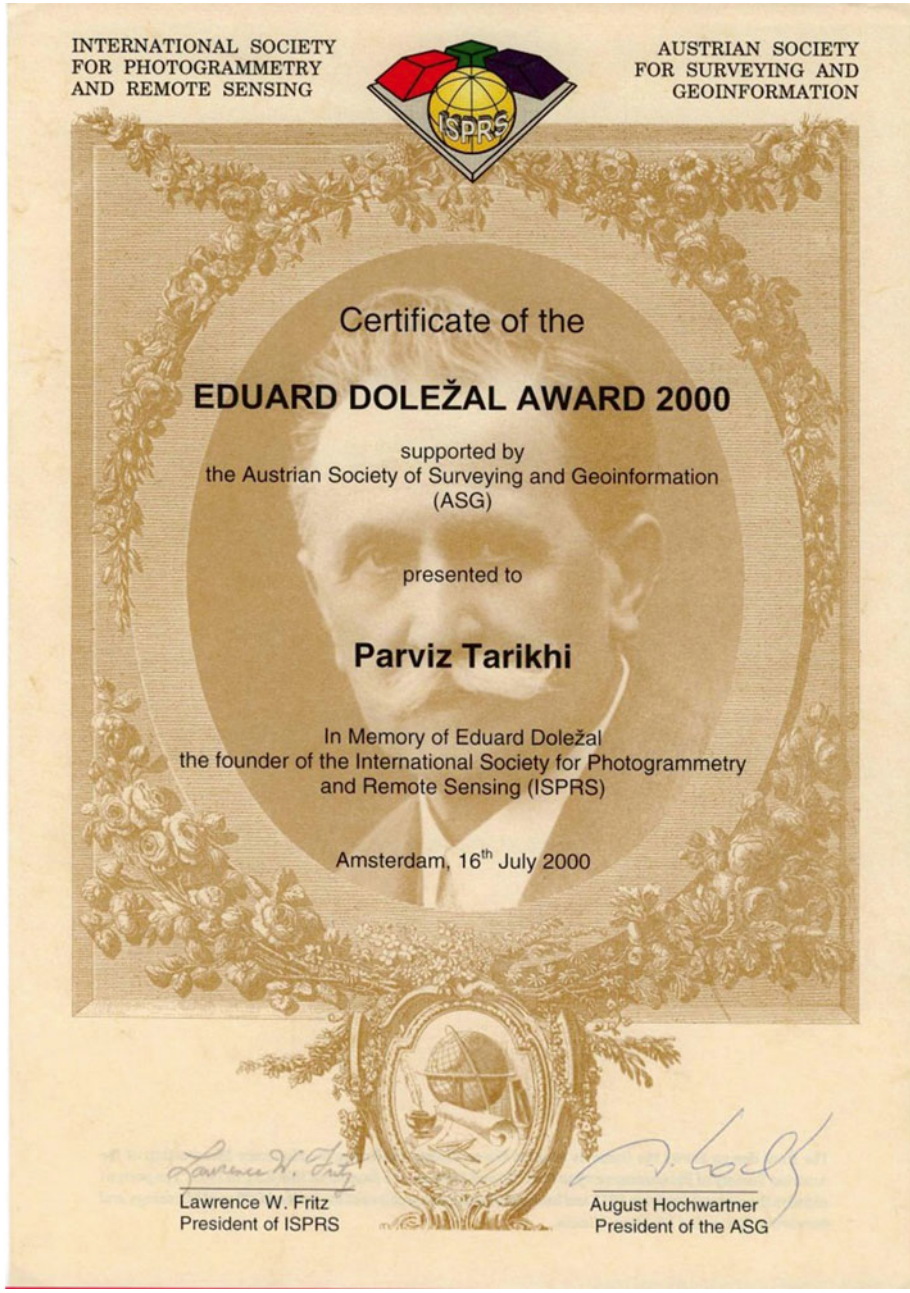
data. With the assistance of the European Space Research Institute (ESRIN), in 1999 I implemented an international study on SAR interferometry. A report was submitted to ESRIN and a relevant paper was presented by me to the 29th International Symposium on Remote Sensing of Environment (ISRSE-29) that was held in March 2002 in Buenos Aires, Argentina.

Owing to my work on promoting remote sensing technology applications in Iran, I was awarded the International Society for Photogrammetry and Remote Sensing (ISPRS) International Eduard Doležal Prize 2000 during the 19th ISPRS Congress in Amsterdam.

I worked as a lecturer at the international level for a training course held in Tunis from May 3-14, 2010 on SAR imagery that covered processing, interpretation and applications. I imparted training on SAR interferometry, DInSAR, and PS InSAR. This program was organized and conducted jointly by the Centre Regional de Télédétection des États d'Afrique du Nord (CRTEAN, Regional Center for Remote Sensing of North African Countries) and the Inter-Islamic Network on Space Sciences and Technology (ISNET).

Active in journalism and scientific writing since 1990, primarily in my native Persian language, I worked with the science magazine *Ganjineh* (Fatemi Publishers, Tehran) and organized and headed the *Bulletin of the IRSC*. I later developed and extended this activity to the English language at an international level. As a member of the International Science Writers Association (ISWA) I have worked as a freelance journalist and technical writer for:

- *International Magazine Geo-Europe* (UK-based remote sensing and geo-information monthly; now ceased publication)
- *ER-Mapper Magazine* (UK-based remote sensing and geo-information software magazine)



Certificate of the Eduard Doležal Prize 2000. [Author]

February–March 2008 • No. 33
POSITION
THE AUSTRALASIAN MAGAZINE OF SURVEYING, MAPPING & GEOINFORMATION
Destruction in the Delta
Forensic GIS
Surveying for Sustainability
Place Takes Games to a New Level

My article entitled 'Destruction in the Delta' in the February/March 2008 issue (No. 33) of the Australian magazine Position. [Author]

- *International Magazine Geo:connexion* (UK-based remote sensing and geo-information monthly)
- *Position* (Australia-based remote sensing and geo-information bimonthly magazine)
- *ASM-Asian Surveying and Mapping* (Australia-based remote sensing and geo-information weekly online newsletter)

- *Spatial Business News* (Australia-based remote sensing and Earth space business news biweekly journal)
- *Independent Daily* (Bangladesh's leading national daily)
- *Journal of Space Law* (USA, University of Mississippi School of Law)
- *Res Communis* (USA, University of Mississippi School of Law blog on the legal aspects of human activities using aerospace technologies)
- *Space Policy International Journal* (Elsevier).

It is notable that my article entitled 'Destruction in the Delta' in the February/March 2008 issue of the remote-sensing magazine *Position*, published in Australia, was recognized as one of the five top articles in the 2008 Aerospace Journalist of the Year Award in the category of ITT Best Space Submission organized by the World Leadership Forum.

And, of course, I have now written this book, which I hope you have found insightful in relation to the Iranian space endeavor.

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